# THE PAPER INDUSTRY and PAPER WORLD

**MAY, 1941 — VOLUME 23 — NUMBER 2**

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Eastern Representative: L. D. Schnabel, 9 Rockefeller Plaza, New York, N. Y. Pacific Coast Representative: Norman C. Nourse, 1031 S. Broadway, Los Angeles, Calif. Entered as second class matter June 29, 1938, at the post office at Chicago, Ill., under the Act of March 3, 1879. Subscriptions in the United States, U. S. Possessions, Canada, Cuba and Mexico, $2.00 for one year or $3.00 for two years. All other countries, $3.00 for one year, or $5.00 for two years.

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THE PAPER INDUSTRY and PAPER WORLD is indexed regularly in *The Industrial Arts Index*. An index to each volume is issued annually by the Publisher as Section Two of the April number.

Member: Audit Bureau of Circulations and the Associated Business Papers, Inc. Published Monthly by

**FRITZ PUBLICATIONS, INC., 59 East Van Buren Street, Chicago, Ill.**

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## BOSTON WOVEN HOSE & RUBBER COMPANY

# TRADE WINDS

## EXPLOSION WRECKS INSTITUTE LABORATORY

▸▸▸ AN EXPLOSION of undetermined origin and of great force wrecked a large student laboratory at the famed Institute of Paper Chemistry at noon on Easter Sunday. The cost of replacement, although known to be high, has not been revealed. Most of the damage was confined to the laboratory, popularly known as the lignin lab. located on the second floor, and the adjoining stockroom. The gratifying thing, in the words of Westbrook Steele, executive director, is that no one was injured, although a student who was working on an experiment having to do with a thesis, left the large room but five minutes earlier. He was not using explosive materials, but they were known to be inflammable.

The interior was entirely wrecked, two walls were blown out, and the ceiling blown down. The roof also was found to be cracked. Steele complimented the Appleton Fire Department on their efficient work in putting out the fire in which they used a minimum amount of water and chemicals which nevertheless caused damage to walls and floors in rooms below. Two minor blasts in the stockroom followed the first as either the fire reached them or chemicals were thrown together.

The laboratory, reconstruction of which was started as soon as the debris was cleared, is about 25x30 feet and the adjoining stockroom about half that size. The last word in a modern organic laboratory is being built in place of the old.

Although the blast was a major one it caused hardly any interruption in the important work being carried on. None of the research work being conducted for member mills from all over the United States was held up in any way.

This marks the first major damage of any cause to the eleven year old institution which is a co-operative venture on the part of paper and allied industries and representing an investment of approximately $1,250,000.

**Looking over the damage done after the smoke and chemicals had disappeared are Westbrook Steele, executive director (white handkerchief) and Herbert J. Becker, assistant to the treasurer, at the Institute of Paper Chemistry where on Easter Sunday an explosion blew out two concrete block walls and wrecked a large student laboratory. A few students may be seen in the background. Interesting to note is the fact that while several fragile pieces of equipment and glass light fixtures shown here survived the blast, light fixtures in Dean Harry Lewis' office at the other end of the building were broken.**

## NEW CANADIAN CO. RESULT OF M & O REORGANIZATION

The reorganization of the Minnesota and Ontario Paper Company has brought about the formation of a new Canadian company, the Ontario-Minnesota Pulp and Paper Company, Limited under Letters Patent granted on April 28. This new company is an amalgamation of the Kenora Paper Mills, Limited; the Keewatin Power Company, Limited; the Keewatin Lumber Company, Limited; the Fort Frances Pulp and Paper Company, Limited; and the Ontario and Minnesota Power Company, Limited.

The officers of the company are R. H. M. Robinson, president; R. W. Andrews, senior vice president; C. T. McMurray, vice president; Donald McLeod, vice president; R. D. Main, secretary and treasurer, and F. J. Hickling, comptroller. All are from Minneapolis with the exception of Mr. McLeod who is from Kenora, Ontario. The directors of the company are R. Robinson, C. T. Jaffray, J. B. Faegre, Shirley S. Ford, R. W. Andrews, R. D. Main, and Robert S. Waldie.

This company will operate as two divisions, one, the Kenora Division, Kenora, Ontario, of which Ralph Bateman will be general manager, and the Fort Frances Division, Fort Frances, Ontario, of which Clarence Larson will be general manager.

## CHICAGO GETS THREE NEWSPRINT CARGOES

The first cargo of newsprint shipped through the Great Lakes this season docked at the *Chicago Tribune* warehouse on the Chicago River April 16. The shipment, consisting of 3,000 tons of newsprint, left the Tribune paper mill in Thorold, Ontario, on April 12 but was delayed by the ice in the St. Clair River.

Other shipments that arrived shortly after the first were the S. S. Sioux with a cargo of 1,817 tons; the S. S. New York News with 2,275 tons; the S. S. Outarde with 1,997 tons of paper; the S. S. Heron Bay with 2,750 tons; and the M. S. Franquelin with 2,045 tons.

These ships will be engaged in carrying this type of cargo all summer. The Chicago Tribune, the Outarde, and the Heron Bay will carry newsprint from the mills to Chicago while the other boats will carry pulp wood from the Ontario forests to the mill in Thorold.

◆

## PULPWOOD DRIVE IS SLOWED DOWN BY LOW WATER

Low water may prevent pulp drives in Maine. Moosehead Lake, which is the storage basin for the waters that carry the pulp and lumber down to the mills, is four feet below normal, and the lumbermen are wondering whether there is sufficient snow remaining around the headwaters to allow the drive to go through as usual. Only about two feet remains at the first of May.

Hollingsworth & Whitney Pulp Company and the Great Northern Paper Company own most of the 100,000 cords of pulpwood waiting on the banks for conditions which will permit the drive to go through. Failure of this material to get moving soon will be felt because the pulp industry is running at peak capacity.

◆

## C-W PAPER COMPANY AWARDS CONTRACT FOR NEW SEWER

A contract awarded by the Crown Willamette Paper Company, a division of Crown Zellerbach Corporation, for the construction of a reinforced concrete sewer system at Camas, Washington, marks an important step toward an ultimately successful program of treating or using paper mill effluent.

The contract calls for construction of more than 1,000 feet of sewer to replace the present open ravines in the South mill yard. The sewer and the ravines will gradually be covered by earth fill. Separate sewer channels will provide for kraft and sulphite liquors.

When the system is completed, it will be possible to connect it with settling basins on a nearby island in the Columbia River, or other facilities that eventually may be perfected for disposing of the effluent.

◆

## VENEZUELA AND CANADA ENTER TRADE AGREEMENT

A recent announcement made by Canada's Trade Commissioner, James A. McKinnon, disclosed that a provisional trade agreement between Venezuela and Canada has been made and it is expected that this agreement will be a forerunner of a series of pacts of this type with South American countries. This announcement is of particular interest to the Canadian papermakers as newsprint is the number one product in South American trade.

The only South American countries that Canada now trades with are Haiti, the Dominican Republic, and Brazil. Cuba, Mexico, Peru, Chile, and Honduras will be approached this year by a Dominion trade mission with the view of signing most-favored-nation pacts.

The tready with Venezuela has been based on an agreement to exchange notes, with both countries agreeing to the most-favored-nation treatment for a year, also options of renewal are contained in the agreement.

◆

## EXPANSION PLANNED AT THILMANY CO.

An expansion program calling for an outlay of approximately $75,000 was started recently by the Thilmany Pulp & Paper Company, Kaukauna, Wisconsin. A new building especially designed to house a new 120-inch asphalt machine to enable the Thilmany concern to laminate paper 120 inches wide is included in the plans. Heretofore, the company has only been able to laminate paper to a maximum width of 84 inches.

The Thilmany concern will continue to turn out the 84-inch asphalt paper, but has found that the increased demand for building and waterproof paper warrants the new expansion on the 120-in. machine. It is expected this expansion will add more employees to the 1,000 workers at present.

## WIS. TREE PLANTING AHEAD OF SCHEDULE

Spring planting operations on the Nicolet national forest in Wisconsin got under way two weeks ahead of schedule this year, due to the unusually warm weather. The plantings involve the setting out of 4,770,000 trees by employees of the WPA and enrollees from six federal CCC camps.

The planting will continue throughout May, four species to be planted in the following numbers: 1,400,000 jack pine, 2,180,000 red pine, 1,000,000 white spruce, and 190,000 white pine. The plantings will cover about 9,000 acres, bringing the total acreage planted since 1934 to 65,000. Under present plans, about 50,000 acres remain to be planted. This job, it is estimated, will require about 10 more years.

It was also announced that a laboratory will be maintained at the Rhinelander nursery to conduct experiments with nursery stock under various conditions to determine survivals, rates of growth, and other factors affecting tree life under the various growing conditions.

◆

## CANADIAN MINES WILL SOON TURN OUT CHINA CLAY

The Canada China Clay Ltd. expects to be turning out kaolin or China clay by July 1, according to a recent report. It is understood that Noranda Mines put up $250,000 to provide production facilities for two important non-metallic minerals on property at St. Rémi, about 75 miles northwest of Montreal. The other substance is silica.

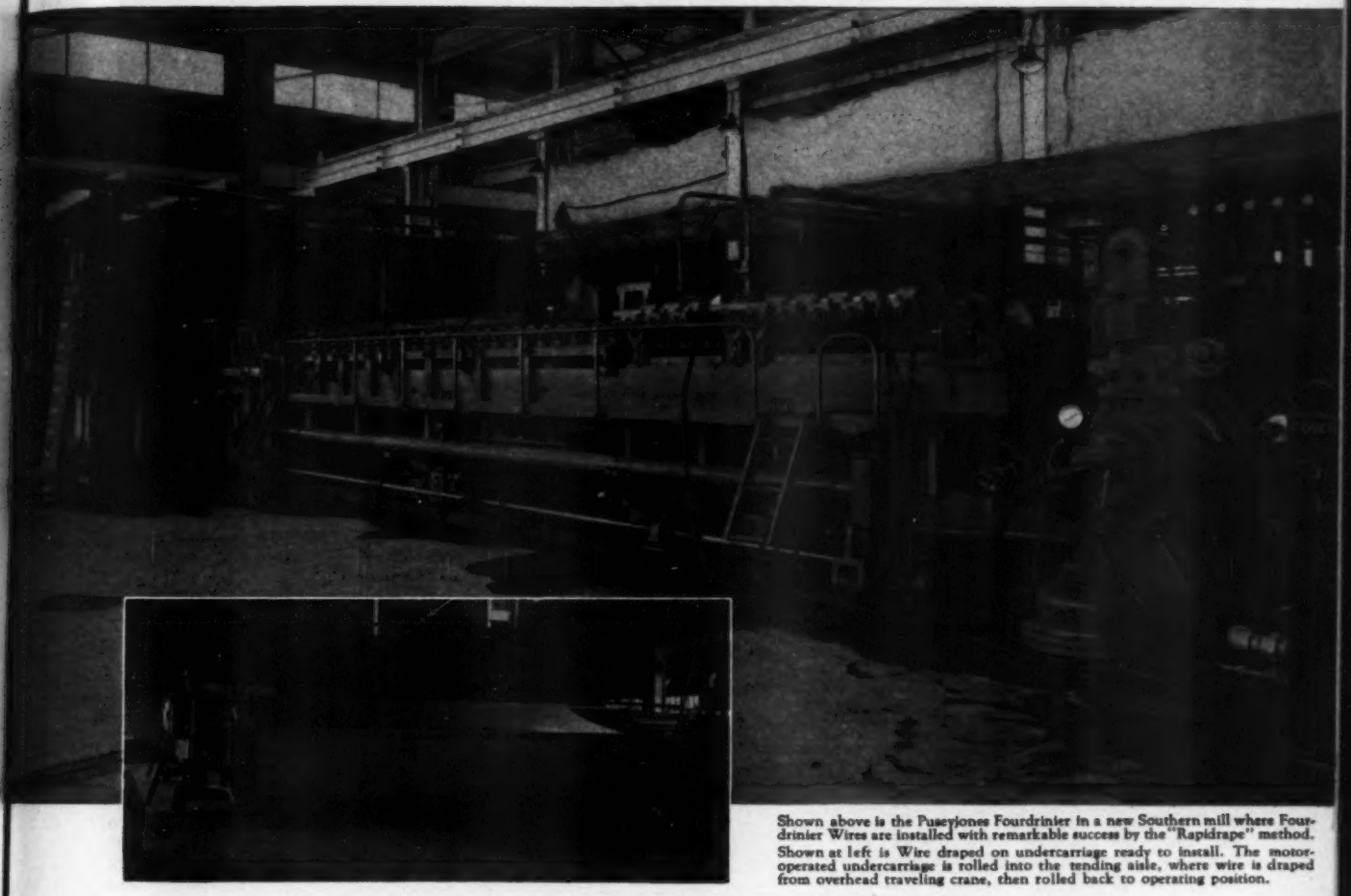
Chief supplies of kaolin are now imported from Cornwall, England, and amount to as much as 65,000 tons yearly. Some also comes from the State of Georgia. The entire China clay output from the mines of the new company is expected to be used in paper manufacture, although a supply will be available for the making of pottery and chinaware.

◆

## CANADA MOBILIZES PULP AND PAPER SKILLED WORKERS

The pulp and paper industry in Canada has mobilized its forces of skilled workers and technically trained staff to render essential assistance to the war industries, particularly those making the heavier types of machinery for the armed forces. The mobilization is three-fold in character. It involves: (1) the use of machine shops existing

# Complete Wire Change in less than one hour with Rapidrape



Shown above is the Puseyjones Fourdrinier in a new Southern mill where Fourdrinier Wires are installed with remarkable success by the "Rapidrape" method. Shown at left is Wire draped on undercarriage ready to install. The motor-operated undercarriage is rolled into the tending aisle, where wire is draped from overhead traveling crane, then rolled back to operating position.

Here is a "stop-watch" record of time and labor saved by the Rapidrape Method for installing Fourdrinier Wires . . . a record made on the 234" Puseyjones Newsprint Machine at Southland Paper Mills, Lufkin (Herty), Texas.

**Typical Wire Changing Performance**
**Lufkin, March 10, 1941.**

**8:30 a.m. Old wire removed, under-carriage rolled out.**
**9:05 a.m. New wire draped, under-carriage rolled in.**
**9:25 a.m. Wire poles removed, breast roll raised.**
**10:20 a.m. Wash-up, stock on.**

**Actual wire change—55 minutes**

Faster, safer wire changing by the Rapidrape Method means that production formerly lost through long shutdowns is reduced to a minimum.

Rapidrape Wire Handling is being used with equally satisfactory results on the 184" Puseyjones all-purpose Machine at the new Hollingsworth & Whitney Mill, Mobile, Alabama. Recently it has been specified for a new 212" Puseyjones kraft paper Machine.

Be sure that your next machine is equipped with Rapidrape Wire Handling—for speed, labor savings and safety. Write for full details.

## THE PUSEY AND JONES CORPORATION

**Established 1848. Builders of Paper-making Machinery. Wilmington, Del.**

THE SIGN OF TRADE MARK SUPERIOR QUALITY

Left—A. B. Hansen, vice president and general manager of Northern Paper Mills, cuts first slice from this huge birthday cake, weighing 200 pounds, at the celebration of the company's 40th anniversary. Right—At one table were seated (L to R) A. H. Wickesberg, a director from Appleton (Appleton Woolen Mills), Mrs. Hansen, Mr. Hansen, and Earle Murray, president of the Northern Paper Mills.

## NORTHERN PAPER CO. CELEBRATES 40th YEAR IN BUSINESS

Over a thousand workers, their wives, and guests attended the recent 40th anniversary celebration of the Northern Paper Company, Green Bay, Wisconsin, which was held at the Riverside ballroom. The mill was founded on March 29, 1901 by the late president, W. P. Wagner, and M. J. McCormick.

A. B. Hansen, general sales manager, acted as master of ceremonies, introducing the directors and the various guests. The president of the company, Earle Murray, spoke briefly on the progress and events during the first ten years after the founding of the company. Mayor Alex Biemeret in his speech praised the mill for the various benefits that the mill has brought to the community and stressed the important role that it has played in the growth and prosperity of Green Bay.

The principal address of the evening was delivered by Jimmy Gheen, professional after-dinner speaker, from New York. There was also a floor show consisting of several acts of vaudeville and a variety of musical numbers.

The center of interest at the party was the huge 200 pound cake which was placed in the center of the big hall and was lighted with 40 candles. Mr. Hansen, who is also a vice president of the organization, cut the first slice of the cake and the chefs from the Beaumont hotel finished the job.

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at most pulp and paper mills for maintenance of their own equipment and machines to make the smaller parts and assemblies needed to complete large machinery units; (2) release or loan of technically trained staff and skilled workers to form the backbone of organization needed to operate war industries now expanding or about to start operations; (3) training schools to educate, by means of short and simple courses of training skilled workers from the general mill staff of the pulp and paper mills so that there will be a steady flow of capable workers to replace those released or loaned to war industries.

All of these activities represent profits for the companies, but they are so planned that there will be no slowing down of the income now being brought into the country from exports of pulp and paper.

## U. OF MAINE AGAIN OFFERS SUMMER COURSE

A summer course in pulp and paper technology and chemical engineering is to be offered by the University of Maine during the six weeks between July 7 and August 15, 1941.

These courses have been designed for paper salesmen, laboratory helpers, etc. who have not had the opportunity to obtain a general scientific understanding of the pulp and paper industry. The pulp and paper courses include lecture courses in pulp and paper manufacturing and laboratory courses in paper making, pulp coloring and paper testing. In addition to class and laboratory work there will be a number of mill visits.

The chemical engineering courses include laboratory work and lectures, the theory of which is based on chemical engineering equipment, some pieces of which are particularly suited to the pulp and paper industry.

A copy of the Summer Session Catalogue, which explains courses offered, expenses, etc. may be obtained by addressing Director R. M. Peterson, University of Maine, Orono, Maine, and if interested, early reservations should be made.

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## SAVANNAH HAS THIRD ANNUAL PAPER FESTIVAL

The third annual Coastal Empire Paper Festival was held at Savannah, Georgia, on April 16 to 19. Long street parades with thousands of spectators, street dancing, midway carnival, water contest, and the feting and crowning of the Coastal Empire royal beauty featured the four days of fun and frolic.

There was also a more serious side to the Festival, the various counties in Georgia, South Carolina, and Florida held exhibits in the Municipal Auditorium displaying the representative features of the individual counties. The central theme of these exhibits was "Health, Happiness, and Prosperity." One of the speakers on the program, Mrs. Madeline Flynt Hosmer, delivered a very interesting and educational talk on "Paper and Its Predecessors."

A military air was given to the festival in one of the parades in which the military from Savannah and nearby army bases paraded in full dress. One of the prettiest parades was that of the school children, individual groups were dressed in costumes and drawing miniature floats representing the central theme of every state.

# GREATER GROUNDWOOD TONNAGE at lower cost per ton

Because of its greater capacity . . its continuous high-speed feed and production . . because of its many operating features that save time and labor and expense . . the new Roberts pulpwood Grinder manufactures more groundwood every hour at lower cost per ton.

**ROBERTS GRINDER**

We will be glad to give you complete details on tonnage, power consumption operating and installation costs of the ROBERTS GRINDER. Write us today.

**THE APPLETON MACHINE COMPANY**

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Canadian Sales - F. W. Roberts Manufacturing Company of Canada, Limited, Niagara Falls, Ont.

# *Miami* MILLS, INC.

▸▸▸ FOR SOME YEARS PAST, industry has marched into the Sunny South. The paper industry has played a prominent part in this industrial trek, and within a short period of time a large number of fine paper mills have gone into production throughout the Southern States. The accompanying illustrations tell the story of an interesting board mill—the Miami Mills, Inc.

This mill, located at Miami Springs, far down in the State of Florida, is associated with a city that has become known everywhere as one of the most popular Southern resorts.

Wastepaper from the Greater Miami area is used by the mill as raw material; other material is shipped from different points in the State.

This company manufactures folding setup box material, plain chip, single and bleached Manila, mist colors, and other grades from .018 to .048 caliper. The capacity of the mill is 30 tons per day.

John E. Oberne is president-treasurer of the company.

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**Above—(L) Exterior view of mill.**

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**Left—Two Noble and Wood 1,000-lb. beaters in foreground; beyond is Noble and Wood 2,000-lb. breaker beater.**

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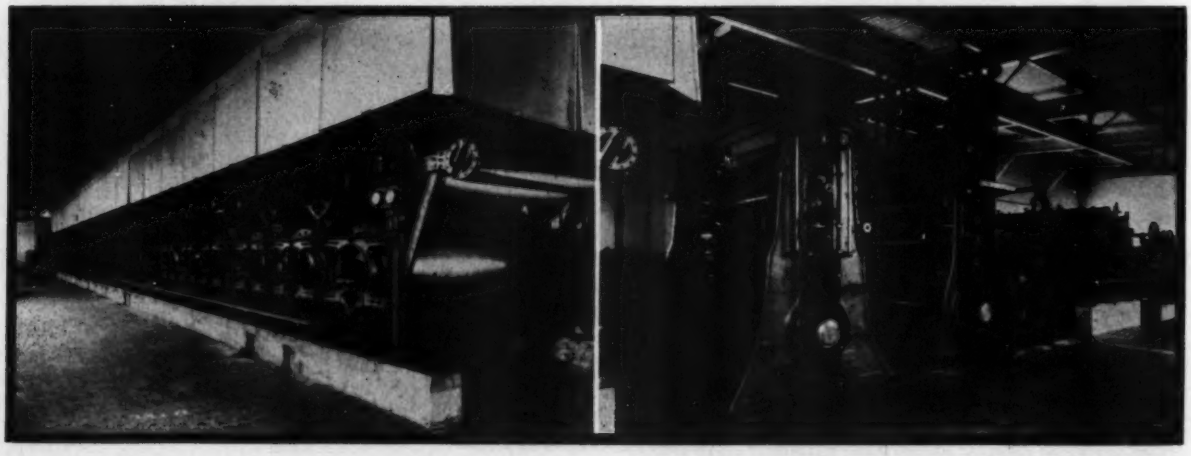
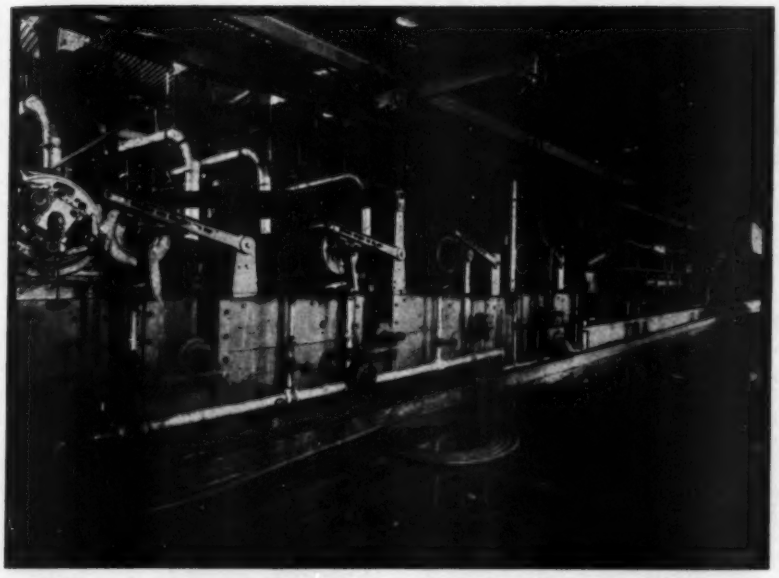
**Below—(L) Dryer section composed of 42 36-in. diam. 80-in. face dryers, individual Stickle traps. Hood furnished by American Blower Company. (R) Calender stacks, center; sheet cutters, right.**





Four-cylinder machine wet end in combination with Harper-Fourdrinier part, 72-in. trim.

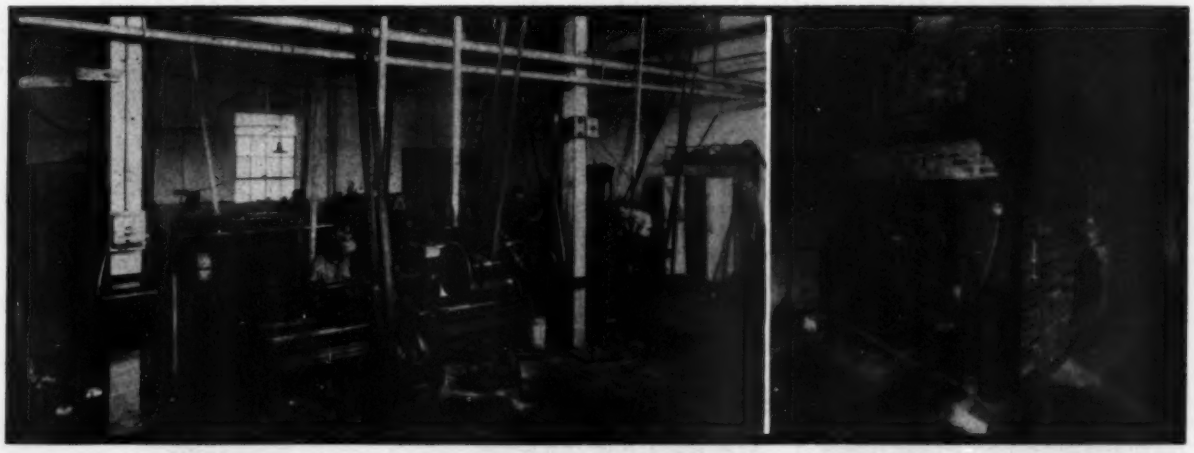
## Paperboard Production

The American Paper and Pulp Association has estimated total paperboard production for the year 1940 as 6,550,000 tons. This is 445,032 tons more than the United States Bureau of Census report for the year 1939, which totaled 6,104,968 tons.

Itemized tonnage for 1940 is not yet available, but the following list for 1939 made up the total:

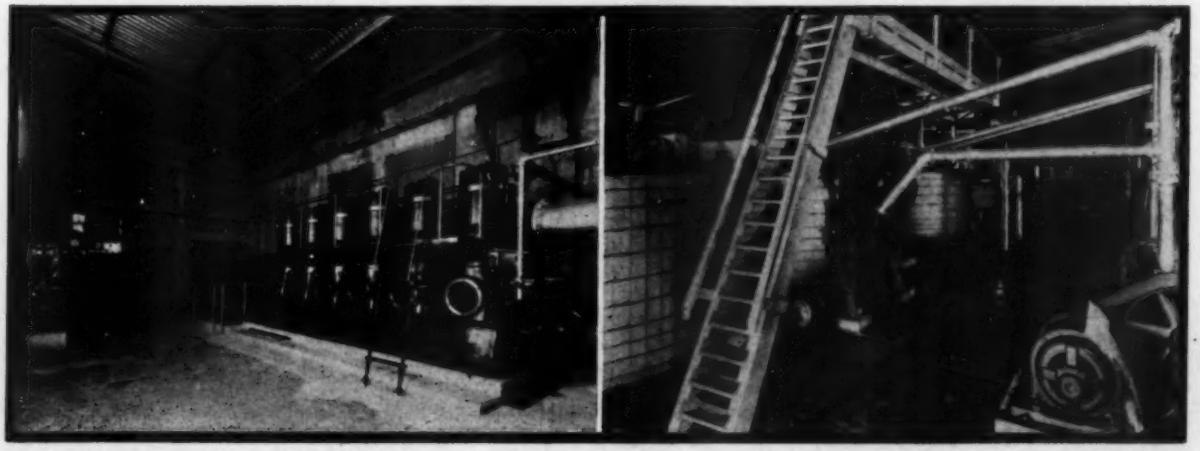
| | |
|---|---|
| Container boards | 3,361,441 |
| Folding boxboards[1] | 1,359,961 |
| Set-up boxboards[2] | 865,485 |
| Binders' board | 28,054 |
| Cardboard | 58,874 |
| Bristol board | 79,474 |
| Leatherboard | 25,714 |
| Pressboard | 7,619 |
| Building boards, Other boards | 318,346 |

(1) Bending; (2) Non-bending.



Above—(L) General view of machine shop. (R) Erie City boiler, rated 250 hp., operating pressure 250 lb., fired by two York Oil Burners. Steam is used to furnish power for steam engines; one on breaker beater, one on machine.

Below—(L) Fairbanks-Morse Diesel engine, 450 hp., directly connected to 300-kw. generator. (R) Stock chest arrangement with reciprocating stock pump in center foreground; jordan in right foreground.



## BADGER FIBER CO. SOLD TO J. LEROY FOR NAT'L DEFENSE

The Badger Fibre Company, Beaver Dam, Wisconsin, has been sold to J. LeRoy, prominent canner. The mill is one of the three hemp mills located in that section of the state which together produce more than 80 per cent of the nation's hemp products.

Mr. Farmer has announced that operations will continue as usual and that hemp acreage this year will be tripled over that of last year to take care of large defense orders.

The plant has for the past seven years been owned by A. A. Butterbrodt of Beaver Dam. D. E. U'Ren, manager of the mill, who has been with the firm for the past eleven years, will continue in his present capacity.

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## IMPORTERS QUESTION DUTY COMPUTATION

Importers of various commodities are protesting against the computation of duties on English goods on the basis of the British official pound. The importers claim that the computation should be on the basis of the free pound, which would mean a lower dutiable value of about 10 per cent. While many protests have been filed in United States Customs Court by importers of other commodities, the first such protest involving paper was made in March on a Philadelphia importation of English drawing paper, according to an announcement by the Import Committee of the American Paper Industry. Later, similar claims were made at New York on drawing, simplex decalcomania and stereotype tissue papers.

Supertone printing paper for rotogravure use imported at a Pacific coast port has been ordered by the Bureau of Customs to be classified for duty at the rate for printing paper. The paper was made in accordance with the provisions for standard newsprint, except for filler, and was found to have 7 per cent ash.

The Bureau of Customs has instructed Collectors of Customs to appraise imported side runs at the Canadian price for standard newsprint, plus the 8 per cent Canadian sales tax. The duty rate will, therefore, be one-fifth of 1 cent per pound plus 5 per cent on this higher value.

Cases involving thirty shipments of various papers from Germany have just been filed in the United States Customs Court, all being based on the claim that merchandise from Germany is entitled, under Most Favored Treaty provisions, to be given the 20 per cent reduction in the duty provided explicitly for merchandise from Germany. It is likely that all of the cases will eventually be abandoned as a result of the various decisions of the Customs Courts against this claim as to other merchandise. The papers involved in these cases include drawing, sketching, imitation parchment, tracing, transfer and onionskin papers, and suitcase board, imported before the European war began.

◆

▶▶▶ THE PROPOSED PULP MILL in the Union of South Africa which plans to utilize the thinnings and tops from pine plantations in the Sabie district has received a serious set back which was caused by the outbreak of war. Arrangements made with Germany to purchase machinery had to be cancelled and an alternative scheme developed. Also the proposed plan for the pulp and paper mill at George has experienced difficulties in obtaining the necessary financial backing because of the international tension which is the subsequent reaction to the outbreak of war.

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▶▶▶ AN ANNOUNCEMENT states that plans are being made for the construction of a new warehouse adjoining the present Buffalo headquarters of the U. S. Corrugated-Fiber Box Company. The addition will be of fireproof construction and will cover an approximate area of 24,000 square feet. The expansion was made necessary because of the increase in business in this district. The Austin Company has charge of this work.

◆

## PAPER INDUSTRY ACTS TO AVOID PRICE INCREASE

Efforts by the Paper Industry to prevent the establishment of a price ceiling such as has been announced for other industries by Leon Henderson head of the Government's Price Administration office have resulted in a series of extensive conferences between Government and Industry representatives. The paper industry is said to be taking every possible step to prevent the arbitrary fixing of price ceiling by keeping the Government officials informed in detail of the industry's situation as affected by wage increases and costlier raw materials.

Much statistical and other detailed information as to industry affairs has already been provided the Government officials and other data will be provided as necessary. The announced purpose of the Government representatives is to prevent any spiraling upward of paper prices.

## FT. WAYNE CO. ANNOUNCES PLAN FOR NEW BRANCH

Two-hundred fifty tons of structural steel will be required for the construction of the new $300,000 branch plant and warehouse for the Fort Wayne Corrugated Paper Company. Construction has been started in Stowe Township, Pennsylvania, and is scheduled for completion by July 1, when the company's Western Pennsylvania sales headquarters will be moved to the new location. This new structure was designed and will be built by the Austin Company, Cleveland, Ohio.

The building will have an approximate area of 83,000 square feet and will be of the monitor type with continuous side wall and monitor sash. There will be enclosed within the structure 320 feet of railroad siding and a large truck loading dock, boiler plant, and complete office layout.

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## FIRST PULP MILL ON WISCONSIN RIVER

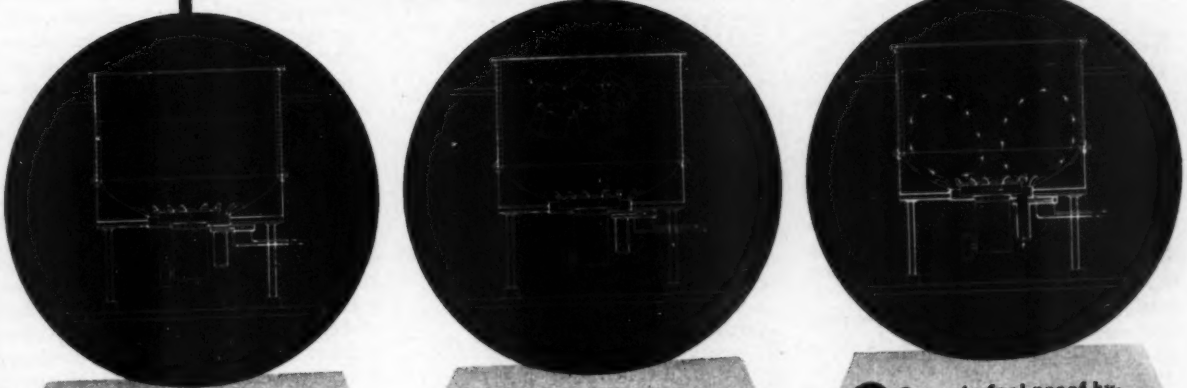
Sixty years ago, two men from the Hoosier State leased the Lyon sawmill at Centralia, Wisconsin, for $1,000 for the first five years and $500 yearly after that. These men, Charles A. Spencer and Walter E. Mack, equipped the Lyon mill to make wood pulp and thus made Wisconsin papermaking history, for on the site of that first wood pulp mill on the Wisconsin River there now stands the present fine plant of the Consolidated Water Power & Paper Company, Wisconsin Rapids.

A cleverly-done article relating this story appeared in the April 25 issue of the *Wisconsin Rapids Daily Tribune*, that date marking the 60th anniversary of the founding of this cradle of the State's paper industry. A reporter for that paper stepped back sixty years and wrote a highly interesting news report of the plans of Spencer and Mack as of April 25, 1881. He relates the skepticism felt by the local people over the idea of a mill to make pulp out of wood; some of the local business men were quoted as saying it would never amount to much on account of the distance the new product would have to be hauled.

But the enthusiasm of those two pioneers was the same spirit that has made this country the great nation that it is. According to research made by a Wisconsin Rapids historian, T. A. Taylor, Spencer & Mack made their first shipment of pulp to the then Valley Pulp & Paper Company, Appleton, Wisconsin, on October 16, 1881. Mr. Taylor records the fact that the bundles of pulp brought $15 a ton, net.

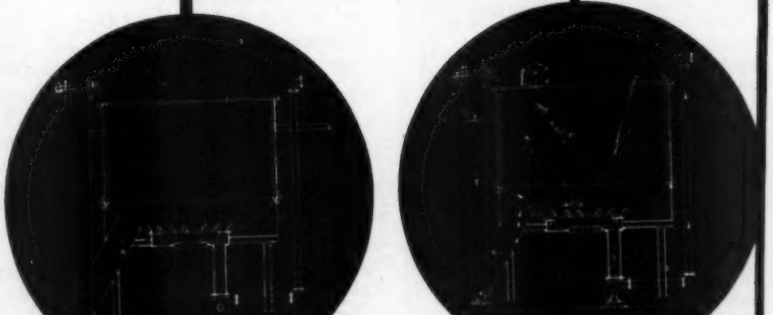
# *Here's the Easy Way—*
# TO OPERATE A DILTS HYDRAPULPER

## B A T C H



1. Fill tub with water to correct operating depth.
2. Dump entire charge . . . start motor running.
3. Operate fool-proof hydraulic valve to empty.

## CONTINUOUS



1. Fill tub with water as shown, start motor.
2. Add stock and make-up water at fixed rate.

### GET THE FACTS ABOUT THIS AMAZING PULPER!

● For batch or continuous operation, nothing can compare with the Dilts Cowles Hydrapulper. If you can charge sufficient water to pulper instantly, you can use the batch method, especially if you run specialties. On larger tonnages and where water must be added more slowly, continuous operation is most satisfactory. On mixed papers, rags and junk are removed continuously, the defibered stock passing through 1/4" perforations to the pump. On batch and continuous with clean pulp, stock passes through 1" perforations.

45 of these Hydrapulpers have been sold . . . an amazing figure when you consider the short time they have been on the market. Write for the full details . . . you will need them.

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**Fulton, N. Y.**
**Division of the Black-Clawson Co.**

**Dilts** *Hydrapulper*

## FINANCIAL

The British expedition into Greece, and the collapse of Yugoslavia, combined with the evident need for very heavy increases in taxes to pay the cost of America's effort, resulted in a gradual decline of American securities to the lowest points of the year. Paper mill securities shared the declines, though earnings statements indicate that the mills have been able to amass sufficient profits to in part compensate for the continued low earning years prior to 1939.

*Central Fibre Products Company*—Net earnings for 1940 were $712,224, as compared with $356,033 for 1939.

*Chillicothe Paper Company*—Net profit for 1940 was $96,879.

*Continental-Diamond Fibre Company*—Net profit for 1940 was $509,652, as compared with $198,625 in 1939.

*Filer Fibre Company*—Net earnings for 1940 were $126,992, as against $28,030 in 1939.

*Gaylord Container Corporation*—Net earnings for 1940 were $1,391,039, as compared with $382,096 in 1939.

*Hawley Pulp and Paper Company*—Improved sales have resulted in a decision to pay a dividend of $7 per share on the preferred stock, the first payment since 1930.

*Hummel-Ross Fibre Corporation*—Net earnings for the three 4-week periods ending March 22 were $155,823 as against $101,267 for a similar period in 1940.

*International Power and Paper Company*—Net profit in 1940 was the highest in the company's history, $15,696,577, as compared with $4,893,590 in 1939. *Southern Kraft Corporation* earnings accounted for nearly $12,000,000 of the total. The profit statement is computed after payment of upward of $10,000,000 in taxes.

*Masonite Corporation*—Net earnings were $302,237 for the twelve weeks ending March 15, as against $254,873 for the similar period in 1940.

*Mead Corporation*—Net earnings for 1940 were $1,426,881 as compared with $744,028 in 1939.

*Minnesota and Ontario Paper Company*—Net earnings for 1940 were $781,232.

*Munising Paper Company*—Net earnings for 1940 were $208,438 as against a net loss in 1939 of $4,728.

*National Container Corporation*—Net earnings for 1940 were $795,671, as against $357,945 for 1939.

*Paraffine Companies*—Net profit for the first quarter of 1941 was $350,294, as against $282,077 for the same 1940 quarter.

*Port Huron Sulphite and Paper Company*—Net income for January was $171,228, as compared with $163,929 for the same month in 1940.

*Puget Sound Pulp and Timber Company*—Net profit in 1940 was $795,553, as against $82,065 in 1939, after a write-off of over $800,000 for taxes in the year just closed.

*River Raisin Paper Company*—Net profit for 1940 was $69,021, as compared with a net loss of $42,684 in 1939.

*St. Helens Pulp and Paper Company*—Net earnings for 1940 were $414,059, as compared with $310,504 in 1939.

*Soundview Pulp Company*—Net profit for January and February was $312,534, as against $346,440 for the same months of 1940.

**New York Stock Exchange—Stocks**

| | Closing Prices April 25 | March 25 |
|---|---|---|
| A.P.W. Paper Co. | *1⅛–1¼ | *1½–2⅛ |
| Celotex | 9 | 9 |
| Same Preferred | 66¾ | 68 |
| Certain-Teed | 3⅛ | 3⅞ |
| Same Preferred | 23¼ | 29¼ |
| Champion P.&F. Co. | 17½ | *18½–19 |
| Same Preferred | 104½ | *103–106 |
| Container Corp. | 13¼ | 13⅜ |
| Crown Zellerbach | 11⅜ | 12¾ |
| Same Preferred | 83 | 86 |
| Dixie Vortex | 7¾ | *8½–9 |
| Same "A" | 35 | 35 |
| Robert Gair | 1⅜ | 1¾ |
| Same Old Preferred | ..... | 17 |
| Same New Preferred | 8⅛ | ..... |
| Gaylord Container | 10¾–11 | *11 |
| Same Preferred | *51½–54½ | *51–53 |
| International P.&P. Co. | 13⅜ | 13⅜ |
| Same Preferred | 64 | 63½ |
| Masonite | 20¼ | 24¾ |
| MacAndrews & Forbes | 25½ | 29 |
| Mead Corp. | 7⅜ | *7¾–8⅛ |
| Same Preferred | *73–80 | *70–78 |
| Paraffine Co. | 27 | *30⅜–32 |
| Same Preferred | *101–102⅜ | *102–105 |
| Rayonier | 11¾ | 13½ |
| Same Preferred | 25½ | 25⅞ |
| Scott Paper | 37¾ | *37½–38 |
| Same Pfd. 4½% | 112 | *114½–115½ |
| Same Pfd. 4% | 109 | 108½ |
| Sutherland Paper | 19⅛ | *21¼–21½ |
| Union Bag & Paper | 10⅛ | 10¾ |
| U. S. Gypsum | 57¾ | 63 |
| Same Preferred | 171 | *167–177 |

**New York Stock Exchange—Bonds**

| | | |
|---|---|---|
| Abitibi 5% | 45½ | ..... |
| Celotex 4½% | 94¼ | 93¼ |
| Certain-Teed 5½% | 85 | 87 |
| Champion P.&F. Co. 4¾% | 104 | 106 |
| Inter. P.&P. Co. 5% | 103½ | 103 |
| Same 6% | 103½ | 103⅜ |

**New York Curb Exchange—Stocks**

| | | |
|---|---|---|
| Am. Boxboard | 4¼ | *4½–4⅞ |
| Brown Co. Pfd. | *13–16 | 15¾ |
| Great Northern | 39 | 40¼ |
| Hummel-Ross | 5⅜ | *5¼–6 |
| Nat. Container | 11⅛ | 12⅛ |
| St. Regis | 1⅞ | 2 |
| Taggart | 2⅜ | *2⅜–2¾ |
| United Wallpaper | 1 | 1¼ |

*Closing Bid and Asked Prices.

# BRIEFS

▶▶▶ A NEW CONCRETE AND STEEL gate section, 1,025 feet long, will be built this summer to replace the timber and rock spillway section of the Consolidated Water Power & Paper Company dam at Wisconsin Rapids. The new structure will contain 10 steel gates, each 30 feet long, with electric hoisting equipment. The project will require approximately 30,000 tons of concrete. The old spillway that is now in use was built in 1903. One end was rebuilt in 1913, to make a solid concrete section with 10 steel gates.

◆

▶▶▶ THE STATES OF Washington and Oregon have set up a laboratory near Camas, Washington, on the Columbia River to make a study of river pollution. John Lincoln, senior chemist with the Washington State game department and who is in charge of the research, reports that little headway has been made determining the cause or cure of the pollution. A similar situation has been found in a river near the Crown Willamette mill at Lebanon, Oregon, and also in the Yakima River near Ellensburg, Washington.

◆

▶▶▶ TWO MORE PAPER MILL REPRESENTATIVES have been added to the staff of the Office of Production Management as $1 per year men. George C. Arthur of the Champion Paper and Fibre Company, Hamilton, Ohio, and Alexander R. Heron of the Crown Zellerbach Corporation, San Francisco, California, have been made district representatives in the Labor Division of O.P.M.

◆

▶▶▶ MILL OPERATIONS at the Ward Paper Company, Merrill, Wisconsin, were slowed down the third week in April when the rising water from the Prairie River flooded the generator rooms. The high water was caused by heavy rains in this section.

◆

▶▶▶ MORE THAN 53,000,000 plants for reforestation purposes have been supplied by the Quebec Provincial Government nursery at Berthierville since its founding in 1909. In the past 30 years the department has planted in 39 townships an area totaling 33,715 acres. During the same time, some 3,000 acres were planted by private individuals and 17,000 acres by forest exploitation companies on various holdings.

▶▶▶ THE STATE AND FEDERAL GOVERNMENTS are fighting the destruction being caused by blister rust, the natural enemy of Wisconsin's white pine. The fight is now being carried on in the million-acre domain of white pine in the state. The annual report, recently released by Wisconsin's white pine blister rust control organization shows that 252,846 acres of white pine have received initial protection by the removal of currant and gooseberry bushes, and that 42,338 acres have been worked over this way more than once. A total of 16,091 acres of white pine and white pine plantings were given protection during 1940.

◆

▶▶▶ A NEW 20-YEAR LEASE on the site of the Westminster Paper Company, Ltd., at New Westminster, British Columbia, was recently granted by the city council at a special meeting, to facilitate a $200,000 expansion program that the company is to carry out. The new lease will replace two existing leases, which have approximately nine years to run. The longer lease is necessary for the financing of the project. The new plans call for the installation of new paper-making machinery.

◆

▶▶▶ CANADA SUPPLIED BRAZIL with over half of the newsprint imported in 1940. This shows a distinct advance for the Dominion, because formerly Brazil has imported most of its newsprint from Scandinavian countries. Since the outbreak of the war, imports from Scandinavia have dropped 70 per cent. In 1939, the Dominion supplied Brazil with 2,838 metric tons as against the 1940 record of 23,990 metric tons, an increase of 21,152 metric tons.

◆

▶▶▶ THE SAULT STE. MARIE Division of the Abitibi Power & Paper Company recently completed the converting of one of the old board machines into a sulphite dryer from which dry sulphite board will be shipped in bales. The new product will be shipped to the western markets. The other departments of the mill will continue to function the same as before.

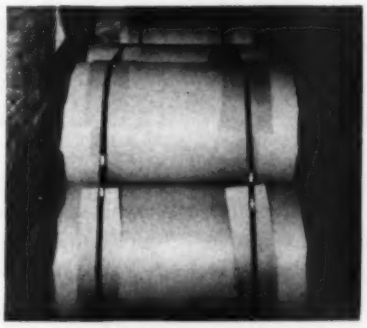
◆

▶▶▶ THE CONTRACT for the construction of additional storage works for power production has been awarded by the Maclaren-Quebec Power Company, a subsidiary of the Maclaren Power and Paper Company, to the Foundations Company of Canada, Ltd. The cost of the construction is estimated at $1,500,000. Work has been started by the contractors, and the contract is scheduled for completion by March, 1942.

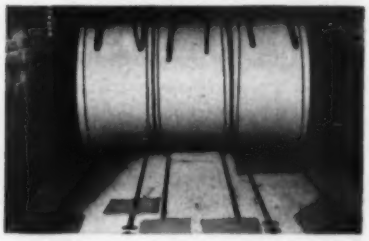

PAPER SHIPMENTS ARE FASTER, SAFER AND MORE ECONOMICAL WITH ACME *Steelstrap*

COOPERATING with paper men, Acme has developed bracing procedures for all types of paper shipments — whether in cases, rolls or on skids. As a result the paper industry has stepped up shipping room output and cut costs. Damage, too, has been reduced . . . resultant claims and annoyances eliminated. Scientifically applied Steelstrap makes every paper lading "Bound to Get There." Shown here are a few of the tested and approved Acme Processes for preparing paper for safe arrival.

Acme tools and accessories are assuring quick and efficient strapping operations. There is one for every job. Write today for full details. An Acme engineer can help you determine the methods and equipment for best preparing your product for shipment.



● *ACME SKID-CHECK METHOD eliminates chafing in transit. Reducing one source of costly paper damage, this scientific and proved remedy is favored by many concerns in the industry.*



● *VERTICAL ANCHOR METHOD is the accepted method for transporting chipboard and other heavy paper. A semi-floating load minimizes movement and prevents damage in transit.*

● *ACME "KEY-ROLL" METHOD for newsprint scientifically overcomes the difficulty of bracing paper in cars. Employing a full-floating load, it makes sure that the shipment arrives in perfect condition.*

● *ACME SKID-LOAD PROCESS provides adequate protection to individual skids as well as carloads at minimum cost. Acme automatically sealfed Steelstrappers do the complete job of tensioning, sealing and cutting the straps.*

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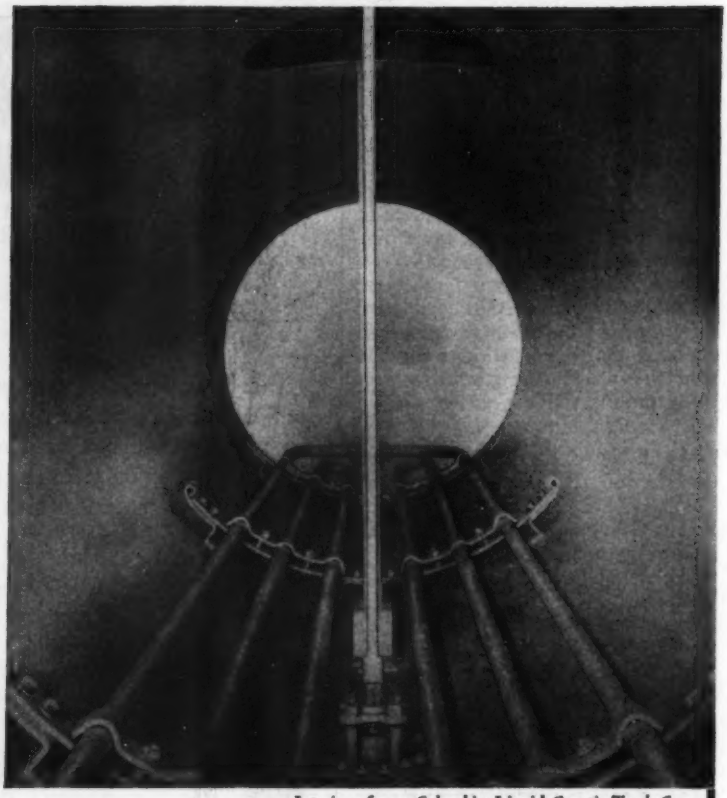

*Interior of new Columbia Liquid Caustic Tank Car*

LIQUID Caustic Soda—even at less than 2¢ a pound—is a costly nuisance if it arrives in a solid chunk the size of a tank car. It may prove worthless if it has picked up metallic contamination en route.

For two full years, we've scored 100% at delivering Liquid Caustic in perfect condition. Because we initiated the development of the most effectively insulated car ever available for the job—and originated the first protective coating capable of keeping even 73% liquid caustic pure en route. Columbia Caustic—in Columbia cars does not pick up metallic contamination. It *stays* liquid throughout normal shipping schedules.

As you might expect, ours is the first complete fleet of the cars now widely known as the "Columbia" type. As you already know, if you now use Columbia products, we think such an expensive "package" for such a low cost material well worth developing. The care we take with their making and handling is the final plus that makes Columbia products more profitable for their users.

Write today for free booklet, "What Happens in Here," describing this new Columbia car in detail.

| | |
|---|---|
| *ESSENTIAL* | • SODA ASH • CAUSTIC SODA • SODIUM BICARBONATE • SILENE |
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# EDITORIAL

## More Adequate Fire Defense

▶▶▶ AS PART OF ITS 75th ANNIVERSARY effort to improve the nation's defense through better fire protection, the National Board of Fire Underwriters has suggested to each industry that it do everything possible to prevent wasting national resources in needless fires. This anniversary will culminate in a nation-wide dedication to future progress in a two-day meeting on May 27 and 28, 1941 at the Waldorf Astoria Hotel in New York City.

May it be suggested that every operating unit in the pulp and paper industry do its part in this important endeavor.

In the pulp and paper industry there have been several very large fire losses. Probably the outstanding ones involved the destruction of pulpwood piles. In a few cases, buildings also have been lost because of fire being communicated to them from pulpwood piles.

Wood-pulp mills often are located where municipal fire protection is poor. Even if such mills are within city or town limits, they frequently are in outlying areas where the water supply may be inadequate and fire apparatus would have to make long runs to reach them. Recognizing these dangers, it has been the general practice to equip pulp and paper mills with automatic sprinklers; and it is not uncommon for such mills to have extensive private water main systems with pumping stations and elevated tanks.

The design of modern pulp and paper mills commonly is left to a consultant who is an expert in the layout of machinery and the routing of material. Sometimes the matter of fire protection is not given the consideration it deserves. The amount of water needed for fire protection and the method of applying it is of such vital importance that plans for new mills, or renovation of old ones, should be submitted to the engineers of fire insurance companies for constructive criticism and suggestions.

Bearings should be inspected regularly and kept well oiled. All wiring extensions should be made by competent electricians. Fuses with a capacity greater than that needed for a circuit should not be used.

Cleanliness, probably, is the most outstanding factor in fire protection consideration. A periodic inspection service, which in some cases may mean a check-up each day in certain portions of the mill, is very important, and a report covering conditions found should be made to the management.

There have been cases where proper consideration was not given to the absorptive properties of paper, with the result that when a fire occurred and water was thrown into the building, the floors became overloaded and collapsed, or piles of paper swelled and dislodged walls or columns. An aisle space should be provided along all walls, and at least 12 inches of open space should be provided between the top of the storage pile and the automatic sprinklers.

Another fire hazard arises in connection with loading paper products onto trucks. To permit loading without damage in wet weather, the trucks often are driven into the building and thus develop a potential fire hazard from discharge of flame from mufflers or from backfire in carburetors. To offset this hazard, suitable extinguishing appliances should be available—some of them should be of the types which can be used on gasoline and oil fires.

◆

## Paper Prices Stable

▶▶▶ THE IMPRESSIVE FACTORS in the paper situation are the orderly and persistent manner in which the demand for paper products continues, and the good sense shown by the paper mills in keeping prices on an equitable basis.

The demand for paper is still on the upgrade. It has not reached a peak and will not as long as the world's warlike conditions obtain and until the expenditures by the Government for supplies and armament levels off. A peace pact between England and Germany would not halt the completion of the defense program, for the people of the United States propose to arm their country so thoroughly that they may not fear any menace to their security from anywhere. For planning paper operations, there is but one course, therefore, to pursue—to plan for a continued demand indefinitely.

The longer these conditions continue in the world, the greater certainty there is that the problems of post-war readjustment will call for capacity operations for the production of curtailed civil commodities, not only for this country, but for all the world.

Already, the hub of the universe is the United States,—it controls the world's finance, commerce, the production of war goods and civil commodities, the greatest ship building, and the biggest and best navy.

All this makes for the continuance of capacity demand for paper for an indefinite period. The paper industry has done a swell job of pricing its products. It will continue to do so.

There has been no necessity for any governmental price control of the industry. There will be none. The present leading producers have demonstrated their ability to keep the pricing factor within sane bounds. That policy will continue. There is not one instance anywhere within the industry of any desire to profiteer.

The industry is to be congratulated also upon the absence of any racketeering. Both employers and employees of the paper industry are welded together in an unified effort to put 100 per cent co-operation behind our industrial defense plan. We say these factors are impressive and they are. They are productive and patriotic also. They are factors which will win wars anywhere.

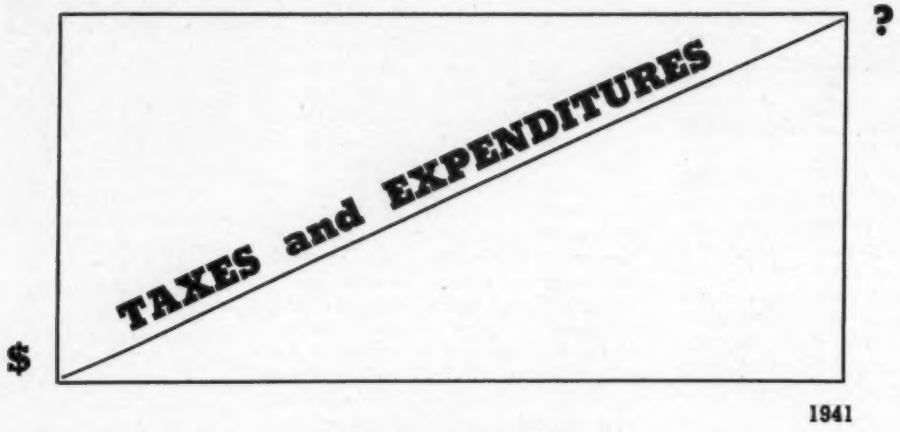
America has been slow to act. The paper industry was quick to act. The declaration of war and the establishment of the British blockade of the Baltic, precipitated an immediate emergency into the lap of the paper business. One-half the pulp production of the world was shut off.

In spite of this situation, the paper industry took the resulting tonnage demand and absorbed it in an orderly and creditable manner, even liquidating the only speculation, which appeared in September of 1939, without any jam in the price structure.

So, today, having every avenue of demand and supply well covered and well known, the only factors that will influence any changes will be those of costs. All costs in every division show rising tendencies. If the Government can keep cost factors stable, prices will remain stable.

We believe we have seen the finest demonstration of stabilized paper prices, especially in view of the tremendous, consistent increasing demand. We believe the stability of prices will continue, and whatever adjustments become necessary, they will be affected without jarring the price schedule unduly. The real crux of the whole matter is that deliveries, not prices, are the essential factors.

# CURRENT THOUGHT




## WILLIAM SIBLEY

▸▸▸ THERE IS SO MUCH CONFUSION and contradiction in the daily flood of press reports of the Congressional debate on the new tax bill that few of us, even those in high places, are certain of their ground. The trial balloons sent up to test the taxpayers' weather, the diverting theories advanced by so-called "economists," the deliberate underestimates of needed future expenditures put out as appeasements to public fear, all serve to blind us to the fundamentals and the basic realities of the question. And this, it must be agreed, is extremely dangerous at this time. We have far more at stake than mere *dollars*. Our concern should extend beyond the mere numerical strength of the money we must pay out this year and next. The very destiny of our economical scheme of things largely depends on the tax *policies* we elect to pursue. There is arresting truth in the statement made by Dr. Harvey Lutz of Princeton University, to the effect that: "The sole purpose of the defense program is to make the nation strong. Bad fiscal methods will weaken it, and the more such methods are used in the struggle to become stronger, the weaker will be the nation in the end."

We have need to watch our present Congress closely. We must make sure it does not ignore the lessons of the past and institute a perilous new period of inflationary borrowing. We must make it aware that we will condone no underestimates of the deficit or overestimates of the sale of defense bonds. Instead of heaping huge new burdens on industry and the middle-income groups, then making up the difference with a miscellany of hidden, undercover taxes, we should see to it that it has the courage to adopt an equitable levy to the extent the situation demands.

More than this, let us aggressively insist that there be drastic economics started in our governmental nondefense budgets. Our defense program we must have. It must be paid for, as nearly as possible, on a pay-as-we-go basis. Many of our nondefense works we don't need, and not needing them, Congress should have a glorious hunt for appropriations that can be decapitated readily.

Why should 1941's aid to agriculture be over one billion dollars, when farm income will total approximately $9,000,000,000—only two billion less than the farm income of 1929, when agricultural aid was practically nil? Why does the National Parks and Playgrounds Commission want a half-million dollars *additional* this year? Why should World War pensions be extended to dependants of veterans who were not disabled in the war—at this time (or *any* time)? Why should there still be a San Francisco World's Fair Commission in Washington, D. C.?

All such things can be eliminated at a time when we need every penny we can scrape together for essential defense work. In the aggregate, the savings in nondefense work might total two billions per year. And true enough, two billions seems relatively insignificant when we have had our financial perspective parboiled by the fierce heat of well over 40 billions in national indebtedness. That *is* a lot of money. It is more money than it cost our Government to run the nation from George Washington's day through 1920. But two billions is a lot of money, too. Two billion dollars would buy 200 destroyers. Two billion dollars would buy 12,000 fighting airplanes—ranging from heavy bombers to high-speed fighters. And two billion dollars, saved each year for five years would total 10 billion dollars—enough to lay a carpet of one dollar bills 80 feet wide clear around the world at the equator. Ten billion dollars would be enough to completely rebuild three cities the size of Chicago should those cities be bombed to extinction or erased by some terrific earthquake.

No one advocates the crippling of essential governmental services. But let's not falsely define "defense" purposes. There is no point in kidding ourselves that ordinary, plain roads which wouldn't stand the weight of a single tank, are "defense highways." Ordinary culverts or plain ditches are not "defense waterways." Our Government will probably spend half a billion dollars in public works and buildings this year largely because you don't take the time to write a vociferous protest against the building of post-offices and highways. We can forego slum clearance this year and next. We got along without it prior to just a few years ago. We can get along without it for the next few years—particularly when doubtless many of the tenants of huge housing projects doubtless will be leaving their apartments to take up residence in some of the many cities that are springing out of sand or sod in the name of national defense.

If our government fails to exercise needed economies in nonessential nondefense services during the next five years—don't blame anyone but yourself. Letters and telegrams are yet a potent force in Washington, D. C.—don't forget that. Congressmen know that you put him there—and that you can retire him. *Make your voice heard!*

# *Section of* Reorganized Commerce Bureau *Assigned to Pulp and Paper Industry*

**A. N. WECKSLER**

▸▸▸ OPERATING ON THE PREMISE that rumor and speculation can do irreparable harm during a period when national defense is the main objective of industry, the Bureau of Foreign and Domestic Commerce of the Department of Commerce is currently being reorganized to establish closer contact with the production and distribution channels of the country.

In the forefront of the recognized setup is the section of the Bureau assigned to the pulp and paper industry. The primary theory behind the new Pulp and Paper Section is the establishment of a close liaison between the Government and all sections of the industry.

**Secretary of Commerce, Jesse H. Jones, under whose administration the Bureau of Foreign and Domestic Commerce is being reorganized to co-operate closer with industry.**

In an interview for THE PAPER INDUSTRY AND PAPER WORLD, Carroll L. Wilson, recently appointed director of the Bureau of Foreign and Domestic Commerce, explained that he has assigned two men to devote their entire time to the problems of the pulp and paper industry.

"These men," he said, will be the Government's source of information on the industry, and at the same time be the industry's men in government."

Elaborating on the new program, the Bureau director pointed out that the policy under the reorganization will be to operate closely in conjunction with the pulp and paper industry on any problems affecting their interests. Statistical and economic studies which cannot be made by trade associations and by private research bureaus will be undertaken by the Bureau if such studies have a wide bearing on industry.

The first step under the reorganization is the publication of a regular monthly report on the pulp and paper industry. This report will be written in the language of the industry, and will include graphic illustrations to present to members of the industry a clear picture of current problems and future trends.

With conflicting influences attempting to sway the pulp and paper industry toward plant expansion, and price and priorities rumors having had a tendency to confuse the industry, the need for concise information has become increasingly felt.

An accurate body of facts, properly interpreted, can provide a true index for the industry to follow, provided, that is, such facts are assembled and interpreted free of political influence. Director Wilson promises this type of facts, and points out that his bureau has no axe to grind.

Nor has the Bureau any intention, according to Director Wilson, to color conditions and attempt to maintain the industrial pace on a false peak of heightened activity.

By his statements of policy, the head of the reorganized bureau shows himself to be a hard-bitten business realist, rather than a fanciful economic theorist.

Director Wilson's attitude toward plant and business management may be illustrated by his statement that each business and trade unit must decide its business policy on the basis of its financial position, and on clear interpretation as to how its position fits into the entire picture of the nation's business. His premise calls for collection of a mass of facts on productive capacity of the industry as a whole, the current market, the trend in demand, and the stability of such a trend.

The long-term objective, according to Director Wilson, is to curb the oscillation of business as much as possible, and this objective can be accomplished, he says, if industry is willing to co-operate in furnishing facts concerning its operation to a co-operating agency of the Government. The Government, in turn, would assemble and analyze these facts, reporting their conclusions to the industry.

Possibly the first job of the reorganized Bureau of Foreign and Domestic Commerce will be to gain the confidence of the pulp and paper industry before the industry is fully willing to co-operate. While the industry undoubtedly recognizes the value of accurate findings of fact and statistics, it has every right to be dubious as to the use to which the Government might put these facts.

**Carroll L. Wilson, recently appointed director of the Bureau of Foreign and Domestic Commerce, is streamlining his bureau to serve business.**

First, on the score of interpretation, industry has found during past periods that statistics have been used,

not to reveal information, but to prove a Government policy or, in some cases, erroneously to justify a political maneuver.

Unquestionably, the pulp and paper industry will co-operate with the Department of Commerce, but before the industry can give full weight to the work of the Bureau of Foreign and Domestic Commerce, the Bureau will have to prove itself.

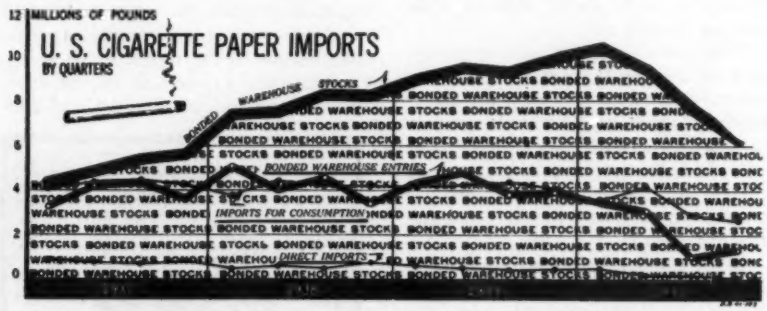
The first issue of the monthly report gives evidence of a great deal of work and of an understanding of the problems of the pulp and paper industry.

The report is essentially analytical, discussing the major current trends within the wood pulp and paper industry, and all factors contributing to the various movements within the industry. Basic data was furnished by all the major trade associations, covering such items as production, orders, shipments and stocks. This data was assembled, and an analysis made.

presentation of the data. Unlike the usual bar or line charts used in the bulk of Government reports, one graph shows an artist's version of an order file, and on the face of this pile is contained a small bar graph showing the trend of paperboard orders during the latter part of March. A similar novel idea was used in a graph illustrating the discussion of cigarette paper imports. (See illustrations).

One section of the April report was devoted to a special article on cigarette paper imports, formerly obtained chiefly from France. In addition, proposed congressional legislation affecting the pulp and paper industry was pointed out and discussed.

In future reports, it is planned to present such subjects as seasonal factors in the pulp and paper industry, the part which paper inventories play in the industry's economy, and similar pertinent subjects. The guiding factor in the selection of these special articles will be their timeliness.




▶▶▶ The first issue of the Monthly Report on the Pulp and Paper Industry (the publication date of which was the middle of April) discussed current developments of demand and production for March. The factors influencing the relatively high orders were pointed out, and the relation of orders to the capacity of paper mills discussed. Following this summary of the current developments, a detailed discussion was contained on all movements within the industry during February.

This discussion embraced the major divisions in the paper, paperboard, and wood pulp industry. It pointed out various trends in the wrapping paper, fine paper, printing paper, tissue and absorbent paper, newsprint paper, and paperboard divisions of the industry. In another section of the report, developments in the wood pulp industry were brought out.

As an aid to a quick understanding of the basic figures contained in the appendix to the report, a series of graphs on the more pertinent current statistics were presented.

Two of these graphs were dressed up in order to heighten interest in the

▶▶▶ The men who have been assigned to undertake this large order are James D. Studley and his associate, John F. Darrow.

Studley, who developed the pulp and paper industry services which the Department of Commerce has been extending in the past, has a solid background of training and experience for his work. His scholastic training was in the economics of forest products, particularly pulp and paper, and for several years he was in charge of field research and special problems at the Forest Products Laboratory, in Madison, Wisconsin. During the six years he has been in charge of the pulp and paper work of the Department, a number of valuable services to the industry have been organized. One of the greatest assets he will bring to the reorganization of the Bureau is his attitude of co-operation with the industry.

In like fashion, Darrow is anxious to do a good job for the industry, as well as for the Government. Darrow served in the Department of Commerce for some time as a dollar-a-year man, doing special assignments in pulp and paper. He has a quick grasp on the problems of the industry.

Both men indicated that neither the proposed type of studies nor the editorial matter in the monthly report will be rigid, and that they are anxious to get response from the industry on what they are doing. Criticism and suggestion will be welcomed by both of them, and new projects will be undertaken if the industry calls for such additional information.

An over-all picture of the reorganization is of interest to the pulp and paper industry, since the problem of business generally apply to the industry.

The changes which have been introduced fundamentally alter all sections of the Bureau, in that instead of many divisions being assigned to various subdivisions of industry, the reorganization calls for only five divisions.

The reason for this change is that specialists assigned to a particular commodity under the former policy became so immersed in trade statistics of every nature that they often lost sight of the specific picture and problem of the industry to which they were assigned.

Many of the specialists were unable to keep their information and outlook on their particular industry current, and as a result lost sight of the fact that much of their reports and economic compilations were of no value to the industry. Reports concerning the bean growth in some far away and insignificant country were not infrequent, and their appearance brought a chuckle rather than confidence from industry and business.

Specialists assigned to particular industries will be required to maintain close personal contact with those industries, and to read their trade journals and publications.

Statistical studies will be handled by a special division, and industry specialists will merely outline what statistical studies and compilations are to be made, with the statistical division handling the details.

Formerly, a great deal of the time of the industry specialists was consumed with foreign trade statistics and foreign markets. In this phase too, the Government is looking toward greater efficiency by assigning these angles to a special division.

The five major divisions under the reorganization are the Division of Research and Statistics, Division of Industrial Economy, Division of International Economy, Division of Regional Economy, and Division of Commercial and Economic Information.

Functions of the Research and Statistical Division are: To study, to analyze and to direct the general aims and objectives of all Bureau activities. To study all facts pertinent to the current state of the commerce of the na-

tion, including the whole complex flow of funds between buyers and sellers, and the evaluation of the national income. To establish and maintain the nation's economic books and records and prepare periodic reviews useful to government officials and business executives. To prepare for the Secretary of Commerce the background and the basis for departmental position on national economic policies.

The Division of Industrial Economy will maintain a clearing house for the exchange of facts between the Bureau and industry. It will establish means and methods for, and conduct economic and statistical studies along lines of practical reality, making each important industry's experience available to all industries and to the government. It will serve as economic counsel to industry and as industrial counsel to the Government.

International Economy Division functions will be to provide the Government, exporters and importers with directive information on foreign economic and commercial affairs and on foreign national policies affecting commerce. The division functions on a regional basis according to the primary regions of world politico-economic influence. It will report on where and how the economics of these regions are moving and how their movements affect our own affairs. Likewise it will analyze and appraise our own balance of international transactions. The division will be responsible for the guidance necessary in the collection of raw factual material by the Foreign Service of the State Department for studies and analyses by the division.

The function of the Regional Economy Division will be to direct continuous contact with the nation's principal economic areas through a field force operating from strategically located offices and through co-operative research stations. The field force will include practical business specialists and trained analysts, backed in Washington by a research unit concentrating on special regional problems. It will assist local business units with facts and counsel developed in the Bureau and provide the Bureau with a continual flow of local data and observations.

The Division of Commercial and Economic Information will determine the format, will edit, publish, and distribute to government and business, informational and timely facts developed by the various divisions of the Bureau.

Pulp and paper will be handled in the Division of Industrial Economy in a special Consumption Materials Unit. In addition to pulp and paper, this particular unit will handle textile manufactures, rubber and rubber products, leather and leather products, paints and varnishes, drugs and medicines, fuels, tobacco, and containers.

▶▶▶ Naturally, the basis of all the studies to be released by the reorganized Bureau, whether they be of the pulp and paper industry or any other industry, will be statistics gathered from industry, and therefore major emphasis is being put on the Division of Research and Statistics.

Of major importance in showing markets and purchasing power will be the National Economics Unit. This group will function as a small and closely integrated unit, studying and reporting on broad economic problems selected for their significance in relation to the current and prospective requirements of the officials of the Bureau and Department. This group will not conduct original basic research, but will draw on the entire factual resources of the Bureau, as well as those of other agencies, in developing required analytical material and recommendations. Its operations will naturally tend to guide Bureau research toward the problems of greatest moment, and will be designed to give as comprehensive a background as possible for guiding major economic decisions.

The problems to which attention is directed at present are those arising from the national defense program, including the long-term effects of present commitments and decisions on the national economy. The unit will study and report upon the effects of major economic legislation; requirements of the defense program in terms of utilization and diversion of resources, fiscal and other requirements for this purpose, and in general, the basic requirements for the full and effective use of our resources.

The Business Structure and Operations Unit will conduct basic research to develop analytical studies, articles and reports upon the structure and operations of business from the standpoint of organization, location and migration, of business or trade practices, and of the comparative efficiency of business operations.

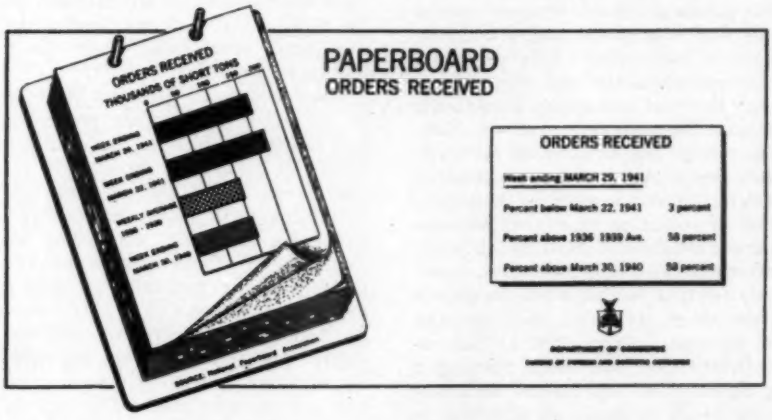
The unit will conduct studies of the flow of goods through the major marketing channels. Business practices and operations which tend to impede the flow of goods will be studied in order that suggestions may be made for improvement. At the same time, proven methods and techniques that increase efficiency, lower costs and speed the marketing of goods will be studied and made available for the use of business. Attention will also be given to the influence of current programs and post-defense adjustments on the distributive trades.

The Current Business Analysis Unit will be responsible for the collection, analysis and dissemination of data on general business conditions, developments and trends. It will conduct a continuing study of the fluctuations in current business activity and of the forces which influence and contribute to these movements. The work of this unit will include the publication of the Survey of Current Business and other reports on general economic conditions and on special phases of the general situation.

An important element in determining business practices is national income, and a special National Income Unit will carry on continuing studies to provide measures and analyses of the national income and income payments to individuals.

On the whole, the reorganization plans seem solid, and while the plans will doubtless be altered to meet future specific needs and problems, the skeleton idea has merit.

In ordering the reorganization, the Bureau of Foreign and Domestic Commerce has, in effect, admitted that its former services to industry have been inadequate, and holds out a promise of making up for such delinquency.


ORDERS RECEIVED
THOUSANDS OF SHORT TONS
PAPERBOARD
ORDERS RECEIVED
ORDERS RECEIVED
Week ending MARCH 29, 1941
Percent below March 22, 1941 3 percent
Percent above 1936 1939 Ave. 58 percent
Percent above March 30, 1940 58 percent

# TESTING PAPER *for Printing Quality*

**M. S. KANTROWITZ**[1]
**and**
**R. H. SIMMONS**[2]

▸▸▸ THE DESIRE FOR SPECIFIC INFORMATION concerning those qualities of paper which tend toward satisfactory results in printing has become of great interest to papermakers and paper users. To the paper manufacturer this information is important in determining before shipment of the paper whether or not it will print properly in the process for which it is intended. To the printer such information enables him to determine before his paper goes to press that it will take the ink properly and possess the characteristics required to reproduce type matter and illustrations satisfactorily.

The correlation of paper and ink in the printing process involves careful technical supervision and the closest possible co-operation of the paper and ink manufacturers and the printer-user, to obtain best results. Paper made to meet the requirements of one printing process may of necessity be different from that made for another process. A very smooth finish, such as that of coated or supercalendered papers, is required to obtain the closeness of contact with half-tone plates necessary for best results in ink transfer in letter press printing, other qualities being equal. In contrast to this requirement for letter press printing, a great variety of paper stocks, including very rough surfaces, are adaptable to the offset process. Uniformity of surface, however, is required in all cases.

Printing requirements have multiplied in recent years since the development of rotogravure and offset, the wide spread use of multicolor printing in all processes and the speeding up of printing equipment. New inks, introduced within the past few years, have also put additional problems up to the papermaker. So many factors involving so many variables enter into the process of printing that it is often difficult to attribute an ineffective appearance of the finished product to very specific causes. It is a matter of experience that ineffective printing frequently blamed upon the paper and the ink, may be entirely due to wrong technique in handling the mechanical phases of the printing process.

Paper testing from the papermakers' point of view has been done to a greater or lesser extent for some 2,000 years and has developed into a definite well controlled system. Methods and apparatus for testing have been standardized by the Technical Association of the Pulp and Paper Industry. Until recent years most of the research work in paper testing was devoted to those properties of paper which are of greater importance to the papermaker than to the printer. In this group of paper tests are included fiber furnish, basis weight, degree of beating and sizing, acidity, ash content (filler), resistance to tear, folding endurance, bursting strength, tensile strength, stretch, gloss, and brightness. It will be noted that most of these tests involve the composition and strength of the paper. While all give useful information, none have much direct bearing on printing.

Consideration of paper for printing is dependent upon other properties and functions which, as far as paper testing is concerned, have until recently been almost entirely neglected. In this group of paper characteristics are finish, meaning smoothness or roughness of surface; ink receptivity; porosity or air permeability; surface strength or resistance to picking; opacity; formation; softness and compressibility; dusting and flaking; expansivity; moisture content; thickness; color and general appearance. The lack of reliable methods for measuring some of these properties of paper has been strongly felt by both paper manufacturers and printers.

If the uniformity of printing quality in any kind of printing paper is to be maintained, laboratory methods of paper testing must be developed for definitely measuring the physical characteristics controlling printing qualities of paper. The performance of a paper in any particular job of printing may then be reasonably predicted before the paper reaches the press. Testing methods must be used which will give numerical measurements of the characteristics that are found to require control. Technicians recently have developed scientific instruments for numerically measuring some of these physical properties of paper to forecast its working quality under printing operations. Even with their limitations and admitted inaccuracies, their use helps the papermaker to produce a more uniform product than he otherwise could.

Paper-testing instruments may be divided roughly into two general classes: (1) those used in the manufacture of paper, and (2) those used to measure the characteristics which affect printing. No single instrument has been developed which will measure printing quality. There are many factors involved in the production of quality printing in addition to several paper characteristics. Dr. Julius Bekk states, (*1*) "The processes which take place in printing and upon which the quality and shortcomings of the paper exert an enormous influence are the following: (a) movement of the web or sheet of paper within the printing press; (b) ink transfer which takes place nearly always during the movement of the paper and which may be considered as the fundamental process of printing; (c) the drying of the ink and the various future interactions between paper and ink which take place in the finished printed matter." No one instrument therefore can measure even two or three of these variables to say nothing of measuring all of them.

## Smoothness

Printing is the process of transferring ink from forms to the surface of paper. The closer the contact of the inked form with the paper surface, the more perfect the transfer. Therefore, the covering power or specific coverage of an ink on a given paper is influenced not only by its absorbability but also by the smoothness of the paper surface. A rough printing surface will require more ink than a smooth one to attain a definite degree of coloring or ink intensity. Smoothness may be regarded as an index of the facility of a paper to make intimate contact with a printing surface under the influence of pressure. It is therefore readily comprehended that for printing purposes, smoothness is one of the most important properties of paper. Smoothness pertains to the mechanical perfection of the paper surface rather than to any optical characteristic. In this respect, it differs from gloss which is determined by measuring the amount of light reflected from the paper surface under certain conditions.

Smoothness governs many other factors required by the printing process. The smoother the sheet the better the contact between the paper and the printing plate. The degree of smoothness necessary is determined by the character of printing required. In order to obtain good smoothness the pulp must be handled in beating and

(1) Technical director and (2) associate chemist, U. S. Government Printing Office, Washington, D. C.

jordaning and on the paper machine in such manner as to yield a well closed sheet. Strength and smoothness are, therefore, not compatible. Strength comes from long fibers and these tend to gather in clumps when freed from agitation. These clumps are thicker than the surrounding areas in the sheet and make it necessary to use higher pressure to calender the paper to a smooth finish. Heavy calendering produces a surface hardness and may blacken or crush the sheet. Smooth papers obtained in this manner show uneven ink receptivity.

Brecht and Pfretzschner (*2*) have shown that in general the smoothness and softness of a sheet increase with an increase in the amount of filler and a decrease in particle size.

One of the most important contributions to the measurement of printing characteristics is the printing smoothness tester invented by Bekk (*3*). With this instrument the smoothness of paper is determined by measuring the time in seconds required for 10 cc. of air to be drawn by a vacuum of 0.5 atmosphere between the surface of the paper and a circular polished glass plate having an area of ten square centimeters. During the test one side of the sample of paper is covered by a soft rubber pad and subjected to a total pressure of ten kilograms or one kilogram per square centimeter. Tests are made on each side separately. The correlation between actual printed work and test results obtained on this instrument have been demonstrated in several printing establishments (*4*) (*5*) (*6*) (*7*). Smoothness of paper was formerly judged by its "feel" and by its reflectance of light when viewed at an angle of approximately 15 degrees. This latter feature is obviously gloss or reflectance rather than smoothness. However, gloss and printing smoothness are not always comparable, a paper having a high value in one may be low in the other.

The Bekk instrument was followed by the Gurley (*8*) and Williams (*9*) (*10*) smoothness testers. The Gurley tester was developed in the research laboratory of the International Paper Company. In making smoothness determinations with this instrument, the sample of paper is held between two highly polished circular metal blocks under a pressure of 0.5 pound per square inch. Air is admitted to each side of the paper through annular slits, about one millimeter wide, in the metal surfaces. Each of these slits is connected to a hollow cylinder bearing a piston actuated by gravity and sealed with mercury. An average pressure of approximately 0.4 pound per square inch, equivalent to 12 inches of water or 22.4 mm. of mercury, is developed by the falling pistons. The smoothness number is the time in seconds required for 5 cc. of air under the given pressure to pass between the paper surface and the test block. The smoothness of both sides of the paper is simultaneously determined.

The Williams smoothness and radial porosity tester employs a variant method by measuring the time in seconds required for a definite amount of air at a definite pressure to be forced outward between the two surfaces of the paper sample folded upon itself. The sample is perforated in the center and clamped between rubber faced plates which seal the two outside surfaces of the folded sample against the escape of air. The results are an average of the smoothness of two surfaces.

These three instruments employ the same basic principle, measuring the rate of air flow between two surfaces. The Williams tester, however, differs from the Bekk and Gurley instruments in that the air flow takes place between two paper surfaces pressed against each other and not between the paper surface and a hard, polished surface as is the case of the two latter instruments. The numerical values obtained by the three testers are not identical. All three are definite improvements over the old method of feeling the sheet, in that they yield numerical values independent of the personal factor. As in the case of any technical testing equipment, experience is essential in interpreting the test results. They measure the smoothness of a given area, and do not take into consideration certain contour variations which at times have a definite effect on printing quality. For instance, a coated paper having numerous tiny foam holes in the coating will show a good smoothness test on any of these instruments and yet will not print satisfactorily. The holes show up immediately when the sheet is printed, but the smoothness test does not disclose them. This is explainable by the fact that each hole is a tiny air pocket, separated from the neighboring pockets. Usually the sum of their total diameters is so small as not to affect the rate of flow of air sufficiently to be noticeable in the test results. The same condition has been found in paper having pronounced wire marks. The depressions caused by the wire also form minute air pockets, the effect of which is easily seen on the printed job, but is not detectable by smoothness tests.

Another defect common to the air flow type of instruments is that they do not differentiate between a surface on which the irregularities are large but comparatively few and one on which they are small and numerous. The same smoothness reading may be obtained in both instances, yet as a rule the sheet with the few but large irregularities will be the better printing paper.

Obviously what is needed, in addition to a smoothness test, is a method of measuring the contours of the paper surface. H. W. Morgan (*11*) has described such an instrument, but it has not been perfected nor its value proved by a correlation of the test results with the results obtained in production printing.

## Ink Receptivity

The amount of ink necessary to attain a particular degree of color intensity in printing is related to both the paper and the ink. One can not speak of the absolute absorbability of a particular paper, but rather of the absorbability of that paper in connection with particular kinds of ink; nor can one speak of the penetrability of a given printing ink, but rather of the penetrability of that ink with respect to a particular paper.

Diefenbach (*12*) brought out the fact that the ink must be designed not only for the process, but for the press, the stock, and the use for which the printing is intended. He states that if the sheet is open the ink will appear flat. The amount of penetration can be regulated in practice to a large extent by the mutual adjustment of the paper and ink. Most papers receive ink partly by adhesion and partly by absorption; therefore, the amount of press impression must be changed according to the type of paper being printed.

The amount of ink used to obtain intensity of color should be limited to the absolute minimum that will give the desired result. Therefore, the quality of the ink used is of great importance, but the composition of the surface of the paper also exerts an important influence. In general, the smoother and less porous the paper the less ink will be required. The nature and distribution of fillers in the paper also exert influences upon the printing quality of the ink, depending on the ease with which they are wet by the vehicle in the ink. Owing to these involved relations it is not possible to set hard and fast rules, by reference to the chemical and physical characteristics of the paper on the one hand and the printing ink on the other, as to the amount of ink required on either printing surface of the paper.

Ink is classified as drying by absorption, by oxidation, by a combination of the two, and by evaporation.

Machine finish and supercalendered book papers require inks which dry

partially by absorption and partially by oxidation. On papers of this type absorption is more important than oxidation. Black book inks usually contain considerable mineral oil mixed with some varnish and drier. Bonds, ledgers, coated papers, and imitation parchments all require inks which dry principally by oxidation. These papers are very ink-resistant and surface oil absorption is therefore an important characteristic of such papers.

Rotogravure printing requires a sheet which will absorb ink, and the ink used contains volatile solvents which are driven off by evaporation after printing. The introduction of quick-drying inks using solvent vehicles which vaporize at high temperatures requires a sufficient degree of absorption to trap the ink on the surface of the paper and take care of a considerable percentage of solvent vaporized into the sheet.

### 1. Ink Receptivity of Absorbent Papers (Oil Penetration)

The penetration of printing inks into absorbent paper such as news and book is dependent primarily upon the vehicle used in the manufacture of the ink. It may be considered as a process of infiltration. Some of the ink vehicle penetrates the paper, but the pigments themselves tend to remain on the surface, except for a small portion which may be forced into the open paper structure by the printing pressure. A measurement of such penetration is informative in that it furnishes an indication of the ink receptivity of the paper. One of the first published works on the ink receptivity of printing papers was that conducted by the Government Printing Office (*13*) in 1928, which dealt with absorbent papers such as mimeograph and newsprint.

Castor oil is used as the standard liquid medium in this test, since the use of printing ink itself for measuring penetrability would involve difficulty in securing an ideal standard ink for the purpose. The variation in printing inks required to suit various kinds of paper and the wide variety of printing inks offered for the same class of printing would preclude accurate comparison of test results obtained with a single standard ink and with those actually obtained on the press. The instability of printing ink is another deterrent factor in its use for this purpose due to the changes occurring in the characteristics of an ink after manufacture caused by chemical and physical reactions between the various components. Another objection to the use of one standard ink lies in the difficulty of accurately measuring test quantities and of securing a satisfactory end point for complete penetration. On the other hand, castor oil, which has a viscosity similar to ordinary ink vehicles, may be obtained in standard U. S. P. quality and does not change with aging.

A modification of the test (*4*) has been used in several printing plants and paper mills for some years, and has proved of value, as the results can be correlated with other factors in determining printability. This test, known as the "oil drop" test, is subject to the judgment of the operator as to the exact end point, and this at times causes varying results. An instrument employing this principle but which uses a photoelectric cell for determination of the end point has been described by Dodge (*14*). Except on newsprint, no data are available to show the correlation between printing and the test results obtained with this instrument.

Hammond (*15*) (*16*) also describes the use of a photoelectric cell for this purpose. Either castor oil or oil inks are used as the penetrating liquid with his tester and the operation of the instrument is based upon the change in light reflectance from the opposite surface of the sheet as the medium penetrates it. The end point is recorded by a galvanometer activated by a photoelectric cell.

A modification of the oil drop method was developed by Grantham and Ure (*17*). In their method they produce a very small drop of oil through a capillary tube and measure more nearly surface penetration. Additional research on the subject of oil wettability of paper has been reported by Cobb and Lowe (*18*) and Larocque (*19*).

Although considerable data are available on the subject of ink receptivity of absorbent papers, the results have not been fully applied in the development of a satisfactory testing instrument which will permit the numerical measurement of such ink receptivity in a scientific manner, eliminating the objections raised to the instruments so far developed.

### 2. Surface Ink Receptivity of Paper (Oil Absorption)

Initial absorption may be regarded as the first factor in the setting of printing ink on the surface of the paper in such a manner that the freshly printed form is not disturbed or smeared by handling. This factor is especially important on high speed presses. If the ink does not absorb readily, many difficulties are encountered during printing. On sheet fed presses offset may occur when the printed sheets are piled. It may occur on angle bars and on the second impression cylinder and in the folder on web presses. Second impression offset is often mistaken for strike-through. In absorbent papers strike-through may be predicted by oil-absorption measurements, a very rapid rate of absorption indicating that the ink will tend to produce strike-through. This defect is seldom experienced on ink-resistant papers.

Inks used on coated and high-density, relatively non-absorbent papers dry partly by absorption and partly by oxidation. The ink or oil penetration test on such papers, especially in the heavier weights, has little or no bearing on the ink receptivity of the surface of the paper. Since surface ink receptivity is an important factor in printing, methods of measuring it are of great importance. Probably the first work along this line was the development of the widely used K and N testing ink by H. N. Case discussed in a paper presented by Kirkpatrick (*20*) at the annual meeting of TAPPI in 1938. This testing ink, although of considerable practical value, is unsatisfactory in that the results are comparative, not expressed numerically, and subject to the usual variations of the personal equation. Furthermore, the ink is affected by the *p*H of the papers and changes color on standing, which prevents tested samples from being preserved for future reference. In this test an excess of the ink is placed on the sheet and allowed to stand for two minutes. The excess ink is then removed and the depth of color of the remaining spot is compared against a standard. This method, using the G-E Reflection Meter to determine the depth of color, has been recommended by Annis (*21*) as a numerical method of determining surface ink receptivity.

Another method (*4*) for determining surface ink receptivity of paper consists of allowing a drop of oil to fall on the surface of the paper and then spreading this drop quickly with a small composition-coated roller of definite pressure across the surface of the sheet, taking the time for the film of oil, thus produced, to break. The results obtained are expressed numerically, but the effect of the personal factor in determining the end point is so variable that results obtained by different operators are seldom comparable. This test has been proved to correlate well with the printed work, and is used to some extent both here and in England (*22*). G. L. Larocque (*19*) has developed an instrument based on the same theory just described. However, no data have been

presented to prove the value of this instrument.

Grantham and Ure (*17*) determine the oil absorption of newsprint by means of an oil-drop absorption method, which is similar to their oil penetration method except that the time is recorded for the disappearance of a drop of oil into one surface of the paper instead of measuring the time for the complete penetration of the oil drop through the sheet.

Dr. Julius Bekk (*23*) has devised an apparatus for studying the absorptive capacity of paper for various printing inks. A weighed strip of the paper under examination is printed with an excess of ink by means of a solid plate having an area of 100 sq. cm. Following this, the surplus ink is removed from the test strip by blotting with smooth paper. The increase in weight of the test strip corresponds to the quantity of ink absorbed by the paper.

Prior (*24*) describes the use of a hand-driven proof press for determining the essential factors of printing, namely, the surface to be printed from (type surface), the proper ink film, the surface to be printed upon (usually paper) and the desirable pressure. He found the press to give uniform results which have enabled the pressure and ink volume to be measured and controlled so that different papers may be compared for their relative printing merits. This method was found useful for predicting the relative behavior of different papers on a commercial press with regard to evenness and depth of printing, strike-through and offset.

An instrument which will measure the surface ink receptivity of paper in numerical terms, in which the end point will be independent of the personal factor, and which will yield test results that can be correlated with production printing is badly needed. Control of this factor is essential in the production of uniform-quality, high grade printing papers.

## Porosity, Air Permeability or Density

This characteristic of paper is its resistance to air permeability. The more readily air passes through the sheet the greater is the porosity. This test is used as a control by most mills. Some maintain that they can control oil-absorption factor by controlling the porosity, while others use the test for indicating certain characteristics in special papers. Larocque has shown that porosity of air cannot be used as a direct control for oil absorption in printing since there are many plugged capillary openings into which oil can be forced but through which air does not pass.

Bekk (*5*) states that porosity, especially surface porosity, is important in order to take up the excess ink necessary to produce the required depth of color in printing.

The instruments used for measuring porosity are the Gurley densometer, the Schopper densometer, and the Emanueli porosimeter. Although the test is not covered by a TAPPI standard method, it is in use in most paper mills. The Gurley tester is in general use and from a practical standpoint it appears satisfactory. Tests made on unprinted areas of sheets on which non-offset wax sprays have been used are unreliable due to the sealing effect of the wax particles.

The Bekk smoothness tester also has an attachment for measuring porosity on small samples. No attempt has thus far been made to determine the relationship between the results obtained on the two instruments. Carson (*25*) has developed an instrument in which he uses a capillary flow meter to measure the air passing through the test specimen.

## Surface Strength (Picking)

Paper is said to "pick" when coating, fibers, or small portions of the paper itself separate from the body of the sheet while it is being printed. Coated paper picks because the adhesion of the ink to the coating is greater than the adhesive power of the coating for the paper, or because there is insufficient bonding strength in the base stock to prevent its splitting. Picking of the coating is not always due to a weakness of the coating material, but may be caused by the use of an excessively tacky ink. If such is the case, the tackiness of the ink must be reduced, since the physical interaction between the ink and the paper coating depends upon their relative cohesive powers.

Picking leaves small white spots on the printed image and is especially noticeable in solid areas. The particle lifted from the sheet may lodge on the printing plate or be carried back through the inking system of the press. If there is much picking, it necessitates frequent washups of the plates and even the rollers and the ink fountains. Picking also clogs the type and half-tones, producing mussy printing. It may be overcome to some extent by reducing the tack of the ink with compounds designed for that purpose. This will reduce picking but it may result in a weak or faded appearance of the printing.

The surface strength or resistance to picking of paper has become a matter of importance since the development of multicolor printing and the speeding up of equipment. Probably the first attempt to measure this factor was the sealing-wax test, familiar to all coated-paper manufacturers. This test, while it does not cover a range of strength figures, is of value and is still used to some extent. Case developed a series of waxes (*20*) known as the K and N waxes for measuring the surface strength of paper. The Dennison Manufacturing Company (*26*) has also developed a series of waxes designed to measure surface strength.

The wax test consists of melting the tips of the wax sticks and then placing them on the surface of the paper to be tested. The waxes have graded adhesive powers, so that when they have cooled and are pulled from the sheet there is an increase in amount of pull administered to the surface fibers or coating. The highest number of the wax in the series which fails to break the surface of the paper is the numerical rating of pick. Both series of waxes have their limitations. Each of the Case (K and N) waxes covers too great a range of surface strength, the set consisting of four waxes as compared with thirty-four in the Dennison set. On the latter, only the first twelve or fifteen are of general importance in printing papers. The waxes below No. 5 in the Dennison series are not as reliable as the higher waxes. It has frequently been found that the wax tests and press performance of papers testing in that range are contradictory.

Bekk (*5*) has developed an instrument for measuring surface strength of paper and expressing the results in numerical terms. This instrument registers the force necessary to strip a sheet of paper from a brass plate to which one end of the paper has been attached by an adhesive. According to Bekk the conditions of the test approximate those existing at the time of impression on the printing press. Little work has been done with this instrument in this country, although it is used to some extent abroad (*27*). No report has been made on the work done here but it appears that one of the main disadvantages is the time required for the test. This is so long that it would preclude its use in paper mill control work.

Comparative tests for pick may be made by rolling up an unknown sample of paper in parallel with a known sample using a brayer and a stiff ink. If the unknown picks and the known does not, the surface strength of the unknown sheet is weaker.

There is need for an accurate, rea-

sonably rapid testing instrument for measuring surface strength or the resistance to picking. The results should be expressed in numerical terms.

## Resiliency, Hardness, Softness, Compressibility

The resiliency of a sheet of paper is an important factor in printing, but until recently no attempts have been made to measure it. This factor is variously described as hardness, softness, compressibility or resiliency; but all describe the same thing, the tendency of the sheet to return to its original thickness after being compressed as at the instant of impression on the press.

This factor can be considered as diametrically opposite to smoothness since a soft or spongy paper tends to return to its original condition after passing through the calenders. For this reason it does not retain the smooth or compressed condition. Larocque, in a study of this factor in relation to smoothness concluded that the product of the softness and smoothness factors is a good index of printing quality, but that smoothness is the more important of the two. The nearer the sheet of paper approaches perfection in smoothness the better is the chance for ideal contact with the printing plate, without undue pressure. It can be seen, however, that of two sheets having equal smoothness and unequal softness factors the one with the greater softness will compress more easily under printing pressure and therefore make better contacts with the printing plate. The degree of softness required depends on the kind of printing being done, since too soft a paper can also spoil the finished work.

Instruments for determining this factor are classed as softness and hardness testers. Bekk (*1*) believes that softness should be determined under both a static and a dynamic load. He has developed two instruments. The one for measuring static load measures the change in thickness of the paper when it is subjected to various increasing loads. The instrument for measuring dynamic load is a swinging hammer the contact face of which is slightly rounded. This hammer is inked and then allowed to act through a definite arc, striking the paper which is backed by a hard steel plate. The diameter of the ink spot left on the paper and the rebound are both measures of the softness of the sample.

The objection to the latter instrument (*28*) appears to be that results on thin papers are appreciably affected by the resiliency of the steel plate on which they are placed during the test. On the other hand some evidence is presented (*29*) to show a correlation between the test results and the printed work.

H. S. Hill in conjunction with the Gurley Instrument Company has produced the Gurley-Hill Softness Tester (*30*). The tests are made by clamping the specimen between a fixed upper orifice plate and one of three interchangeable lower plates. The lower plate for this test has a raised annular ring from which four polished steel plugs project. These plugs are 0.002 inch high and 0.1 inch in diameter and are evenly spaced around the annulus. The specimen is punched and inserted between the upper and lower plates. The plugs on the lower plate are forced against the paper surface. Air leakage takes place between the paper surface and the lower plate. The softer the paper, the greater is the depression of its surface by the plugs and therefore the slower the air leak.

Larocque (*31*) describes the new Gurley combined softness, smoothness and porosity tester with a report on laboratory tests on softness and smoothness. The data presented, however, are not substantiated by correlation with pressroom performance. It would appear that further work with this instrument is desirable to prove its value.

It is certain that properly proved testing equipment which will actually measure the hardness or softness of paper under printing conditions is needed.

## Formation

A closed and uniform formation in the paper structure is desirable for the production of good printing. A "wild" or open formation is attended by thick and thin, as well as hard and soft, spots. No amount of make-ready can overcome the obstacles presented to printing by paper having a wild formation. Under such conditions the ink will be unevenly distributed, resulting in mottled or spotty printing. There is some tendency for the denser spots where the fibers have been clumped together to act as bearers and reduce the printing pressure or squeeze on the thin spots. Where this takes place a "kiss" impression results on the thin spots, causing mottled printing. The pressure must be increased, often to the point of embossing the sheet, to overcome this; and even then the printing is of poor quality.

At present, formation is measured almost exclusively by comparison methods using pre-determined samples as standards. As a result no two mills, even in the same company, have the same standards and the results are seriously affected by the personal equation. One formation tester has been placed on the market but sufficient data (*32*) have not been presented to prove the practical value of this instrument.

## Opacity

A high degree of opacity is essential in printing papers. Technically, opacity is expressed in terms of either contrast ratio or transmitted light. In the measurement of contrast ratio the paper is backed successively by a white block of magnesium carbonate and by a black body. The intensity of light reflected from the surface of the paper, under these conditions of total reflection by the white body and partial absorption by the black body backing the paper, is interpreted into numerical terms by various devices in different instruments. The reading obtained with the black body divided by the reading obtained with the white body gives a decimal known as the contrast ratio. Opacity is also expressed in terms of transmitted light by measuring the amount of light which passes through the sheet of paper from a standard light source. Opacity expressed in terms of contrast ratio is not numerically identical with opacity expressed in terms of transmitted light.

A third form of expressing opacity is in terms of contrast ratio where the white body is replaced by a pad of the same paper on which the opacity reading is being made. This simulates the effect of show-through of printed matter on succeeding pages in a book and the opacity reading is called printing opacity.

Deficiency in opacity is chiefly responsible for printed matter showing through from the reverse side of the sheet and thereby interferes with legibility. A transparent printed sheet when backed by other printing is difficult to read. Opacity is often blamed when strike-through is the cause, strike-through being excessive penetration of ink vehicle into the paper, thus making the printed matter visible on the reverse side of the sheet. The introduction of fillers having high refractive indices, hence greater binding power, has added materially to the opacity of book papers.

There are several instruments which measure opacity (*33*). They are the Bausch and Lomb Opacimeter, Bureau of Standards Opacimeter, Cambridge Opacimeter, the Zeiss Pulfrich Reflectometer and Westinghouse Transometer. Some measure reflectance and transmission and others transmission only.

## Flaking and Dusting of Paper Surfaces

These terms may be applied to a condition of paper when loose or pulverulent materials are separated from the paper by friction or pulled away by the action of the printing ink. This fiber or dust sticks to the rollers and printing plates and interferes with good printing. Flaking or dusting may also seriously contaminate the ink by the particles being carried back into the ink fountains by the rollers. Most of these are free fibers or dust particles adhering mechanically to the paper but not an integral part of it. Material of this kind is formed by dull cutting knives or by dust or dirt being deposited on the paper in the course of manufacture. This type of material is just as troublesome as picking but much of it may be removed by vacuum or dusting devices. Flaking or fluffing is an objectionable feature, particularly in offset and lithographic papers, and dusting is objectionable in any printing paper.

An instrument designed to determine the amount of fluffing material was developed by Riesenfeld and Hamburger (*34*). Its use and comments on the results are described by Riddell (*35*). Various other devices for the visual detection of fuzz or lint have been described in the literature. However, none of the instruments has been used to a sufficient extent to prove which is the better, or which, if any, have real value. As in the case of other tests, a satisfactory instrument will be one in which the results are expressed numerically, and which will yield results in a relatively short time. The results must of necessity be in line with printing performance. It is quite possible that the two factors, flaking and dusting, will have to be measured independently.

## Abrasive Particles

Abrasive materials are occasionally found in paper, sometimes occurring in the filler and sometimes being carried in by the water. No matter what the source, their presence on the surface of the paper constitutes a hazard, particularly in rotogravure printing. Even in letter-press printing such particles have been found to abrade or otherwise damage the printing plates but in rotogravure there is a greater possibility of damage as the particles tend to scratch the surface of the copper printing cylinders.

Bekk (*36*) has devised an instrument which will indicate the presence, amount, and relative sizes of such particles. Although no data are available, other than Bekk's reports, several of these instruments are in use in paper mills and research laboratories (*37*). The results are not expressed numerically, but are determined by comparing glass slides, on which scratches have been made by the paper. A set of comparison standards is used in interpreting the results.

## Moisture in Paper

The measurement and control of the moisture content of paper, particularly that of sheet paper intended for multicolor work, is essential in the production of quality printing. Two instruments are available for rapidly measuring the moisture content of paper, the sword hygrometer designed by the Lithographic Technical Foundation and the Cambridge Sword Hygrometer. Both work on the same principle. The Cambridge instrument indicates results in per cent relative humidity while the Lithographic Technical Foundation instrument indicates whether the relative humidity of the paper is above or below that of the pressroom.

## Expansion and Contraction

Paper, since it is composed of a felted mass of minute vegetable fibers, is hygroscopic, that is, susceptible to humidity changes. It absorbs or gives up moisture with every change in the amount of water vapor in the air. With an increase in humidity, the individual fibers absorb more moisture and consequently swell or lengthen themselves. The combined swelling or lengthening of the mass of minute fibers causes an increase in the sheet size. Decrease in the relative humidity causes contraction of the paper stock. These changes in sheet sizes make accurate register difficult. The type of printing most affected by changing atmospheric conditions is multi-color reproduction when done on single or two-color presses. Exact register is necessary and this is seriously affected by expansion or contraction of the paper, caused by the paper and pressroom being at different relative humidities.

Dimensional changes due to varying humidities are greater across than with the grain of the paper. It has been stated (*38*) that a variation in relative humidity of 5 per cent may cause faulty register and consequent impairment of the appearance of the work.

Weber (*39*) studied the reactions of lithographic papers to variations in atmospheric humidity and temperature. Samples of lithographic papers were conditioned and tested in atmospheres of 30, 45, 65 and 75 per cent relative humidity. He found that in an atmosphere of 45 per cent relative humidity different papers showed a minimum variation in expansion. Slight variations in relative humidity from 45 per cent produced changes in expansion of smaller magnitude than occurred when other humidities were taken as standard. These findings would seem to point toward 45 per cent relative humidity as having definite advantages for lithographic plants.

He also found the moisture condition of the surrounding air determined the moisture content of lithographic papers which governed to a considerable extent its properties, particularly the dimensional changes. Humidity changes were observed to be most important, a 10 point change being sufficient to cause such a variation in the moisture content of the sheet as to result in altered dimensions producing serious misregister.

Further studies (*40*) revealed that it was possible to maintain constant dimensions by two methods of conditioning. One consists of conditioning first at a very high relative humidity, then to equilibrium with the pressroom atmosphere by desorption. The other by conditioning to equilibrium with relative humidity 5 to 8 per cent above the pressroom condition. The latter procedure is the more practical since it requires conditioning the paper but once.

A method (*41*) for measuring the expansivity of paper is now under consideration by the Technical Association of the Pulp and Paper Industry. The expansivity is here defined as the change in length of a strip of paper which occurs with decrease of moisture-content in equilibrium with 65 per cent relative humidity. The specimen is prepared for test by conditioning first at approximately 50 per cent relative humidity, then at 80 per cent or above to minimize hysteresis effects. From the high humidity it is conditioned downward to 65 per cent and then to 50 per cent relative humidity, the conditions under which measurements are made The test specimen consists of a strip one inch wide cut lengthwise. A tension of 50 grams is applied to the strip.

## Thickness

Uniform thickness is essential for good printing. Variation in the thickness of paper results in variations in blackness or color intensity, and impairs the printing quality of the sheet. It is really comprehensible that if the press make-ready is prepared for a certain thickness of paper, a thinner sheet in passing through the press will not receive the same degree of impression and will not, therefore, receive the full tonal value of the ink. On the other hand if the press make-

ready is for a thin paper, any paper of greater thickness will receive a heavier impression, forcing the type into the sheet and producing an embossed effect on its reverse side. This heavier impression may also cause the appearance of strike-through by forcing the ink deeper into the paper.

## Color

Variation in color of book paper, writing, bond and ledger paper is not only encountered among shipments from different contractors but sometimes occurs within the same shipment. The difficulties which arise from variation in color of paper can not be corrected or allowance made for such variation in the pressroom. On a long-run job it is sometimes necessary to supply the pressroom with paper taken from different shipments. If the color of successive lots of paper differs somewhat during the press run and the ink remains the same, there will be a variation in the tone value of the printed page, since the ink formula and its tonal quality have previously been adjusted to the color of the paper first used. This objection becomes a very strong one when the paper deliveries can not be segregated to individual jobs but must be used in large edition runs. TAPPI Standard T442-M covers the official methods for measuring the spectral reflectivity and color of paper relative to magnesium oxide.

Color measurements may also be made by means of a trichromatic colorimeter (*42*). In this instrument light from a lamp passes through three filters in amounts controlled by means of variable shutters, provided with scales. The colors of the filters are those of three primary lights, that is, red, green and blue-violet, and by thoroughly mixing the light which has passed through each, which is done inside the instrument, all colors can be reproduced and may be seen through the eyepiece. In making a color measurement the positions of the shutters are adjusted until the mixed light matches the color of the specimen under test; the scale readings are then taken. From these scale readings the hue, saturation and brightness of the color may be calculated.

## General Appearance

One of the most objectionable features of paper is an unsatisfactory general appearance due to inclusion of dirt. Microscopic examination of the dirt generally found in paper reveals that it consists chiefly of black mineral and resinous specks, shives, or pieces of wood. Metallic particles have often been found imbedded in the paper. They probably arise from wear of some sort of the manufacturing equipment such as the wire screen of the paper machine or particles from the beater roll. An unsatisfactory general appearance of paper surface may also be occasioned by crush during the calendering process, thus producing a variegated surface and giving to the paper a mottle appearance, or it may be due to the presence of slime spots, calender marks, colored fibers or even to poor fiber formation during the manufacture of the sheet. The presence of dirt destroys the effectiveness of good printing, and is particularly degrading to the highlight effects in halftones.

TAPPI Standard T437-M describes the tentative official procedure for determining the quantity of dirt in paper in terms of its equivalent block area and is reported in parts per million. This method is based upon work reported by Clark, Hamburg and Knoll (*43*) (*44*).

A rapid method for identification of dirt by means of a dichotomous key is described by Parkinson and Sherman (*45*). Microanalytical methods for exact identification of specks in pulp and paper have been applied by Browning (*46*). Rubin and Rubin (*47*) describe the techniques employed in classifying and analyzing spots and specks generally encountered in pulps and papers. A description of the methods used at the United States Forest Products Laboratory for determining the dirt count of pulp and paper was reported by Simonds, Billington and Baird (*48*).

## The Proof Press as a Means of Evaluation

The nearest means of reporting the printability of paper as a whole is probably reached by means of a proof press. Prior and Larocque are the principal exponents of the proof press in testing the printability of paper. Niemczyk (*6*) has recommended the use of the proof press and in the report by Wehmhoff, Clark and Boyce (*49*) all papers tested were given printability tests on a Hacker Proof Press. Prior (*59*) has developed a number of specific tests as the result of his experience with the proof press. He has proven that the "Relative printing qualities on small tests remain relative on large presses." He has developed that "with a given inking this (receptivity) can be described as the overall visual impression of blackness (or depth of color) of a solid print." The proof press clearly shows surface irregularities when solids are printed. It can be used to show whether the ink or the paper is at fault in the case of the failure of a gloss ink to give glossy prints. It can also be used to indicate drying time, and extent of show through and strike through.

Larocque (*50*) has developed similar relations in the use of the proof press. The technique depends to some extent on the proof press used since there is a difference in their construction. Prior used a Verax precision proof press, Larocque employed the Vandercook, and the Hacker was used at the United States Government Printing Office. Niemczyk used a two-revolution, two-color proof press designed at the W. F. Hall Printing Company. In all cases, the skill of the operator is a very important factor.

Riddell does not favor the proof press as he maintains that all the variables known to printing are introduced and if poor results are obtained it still becomes necessary to track down the trouble by the individual methods before outlined.

## Conclusion

All the above factors enter into the printability of paper. Printability is an important but rather all-embracing term. It is just as much a part of the printing vocabulary as "feel" or "general appearance" is in the vernacular of the paper mill. However, it is difficult to define in numerical terms.

In every class of paper the physical characteristics are subject to many variations. The variation in smoothness, penetration, absorption, porosity, formation, opacity, thickness, amount of ink required and other variables result in variations in the quality of the finished product.

The paramount requirement for paper is therefore uniformity of physical characteristics. Even with the best of materials and attendant operating conditions, close co-operation between the papermaker, ink maker and printer is most essential for obtaining the highest quality of effective printing.

**Acknowledgment** — The authors express their appreciation to B. L. Wehmhoff, of the West Virginia Pulp and Paper Company, for the use of abstracts from his article, "Paper Testing," and for other valuable suggestions in the preparation of this paper.

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# INSTRUMENTATION *in Pulp and Paper Mill Power Plants*

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▸▸▸ THE DEVELOPMENT OF instrumentation throughout the pulp and paper industry has gained in momentum rapidly during the past decade as more and more operators have come to realize the savings effected. Probably of the greatest recent concern and the widest interest have been the steps made in combustion control and instrumentation in the mill power plants.

Steam costs represent a large part of the total cost of making pulp and paper. Through instrumentation these costs have been sliced, making it no longer necessary to put up with the expense of wasted steam and fuel. Meters and automatic control save fuel, increase boiler capacity, reduce maintenance cost, add to operating safety; and then, control steam to the various departments and aid in the accounting of departmental costs. But that's ahead of the story.

## Typical Mill Power Plants

Let's look at a typical pulp and paper mill power plant setup. The steam is generated in at least one power boiler and one recovery boiler. The power boilers each have a normal rating of 30,000 to 250,000 pounds of steam per hour, and from 3,000 to 20,000 square feet of heating surface. The furnace may be fired by pulverized coal, oil, gas, bark, or hogged wood; or it may be fired with oil or gas and be provided with an extension furnace for burning bark.

The recovery boilers have a normal rating of 20,000 to 70,000 pounds of steam per hour, and have from 3,500 to 12,000 square feet of heating surface. The recovery boiler furnace burns black liquor, and also may be equipped with fuel oil burners which make it possible to burn oil and black liquor either separately or in combination.

Both the power and recovery boilers are equipped with forced draft fans, induced draft fans, air preheaters and superheaters, but may or may not have economizers. The forced and induced draft may be controlled by dampers or vanes and by variable speed controls on the fan motors, either separately or in combination.

The problem, then, with the use of instrumentation and automatic control, is to operate these boilers at their greatest efficiency, consistent with both safety and economy.

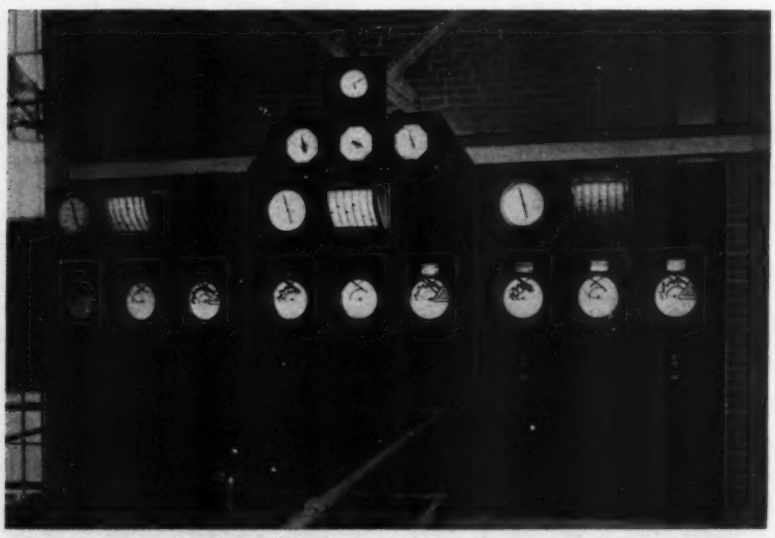
## Combustion Efficiency

There is a theoretical amount of air required to completely burn a specific quantity of fuel or to liberate a specific quantity of B.t.u. (In coal burning, approximately 7½ pounds of air are required to liberate 10,000 B.t.u.'s.) Due to the fact, however, that the air passing into a furnace could not possibly manipulate itself to bring every bit of its oxygen in contact with every bit of the fuel, more air than is necessary for complete theoretical combustion is needed. It might be said that the extra air is needed for complete "practical" combustion. Without it, part of the fuel would remain unburned, and there would be unburned gases going up the stack.

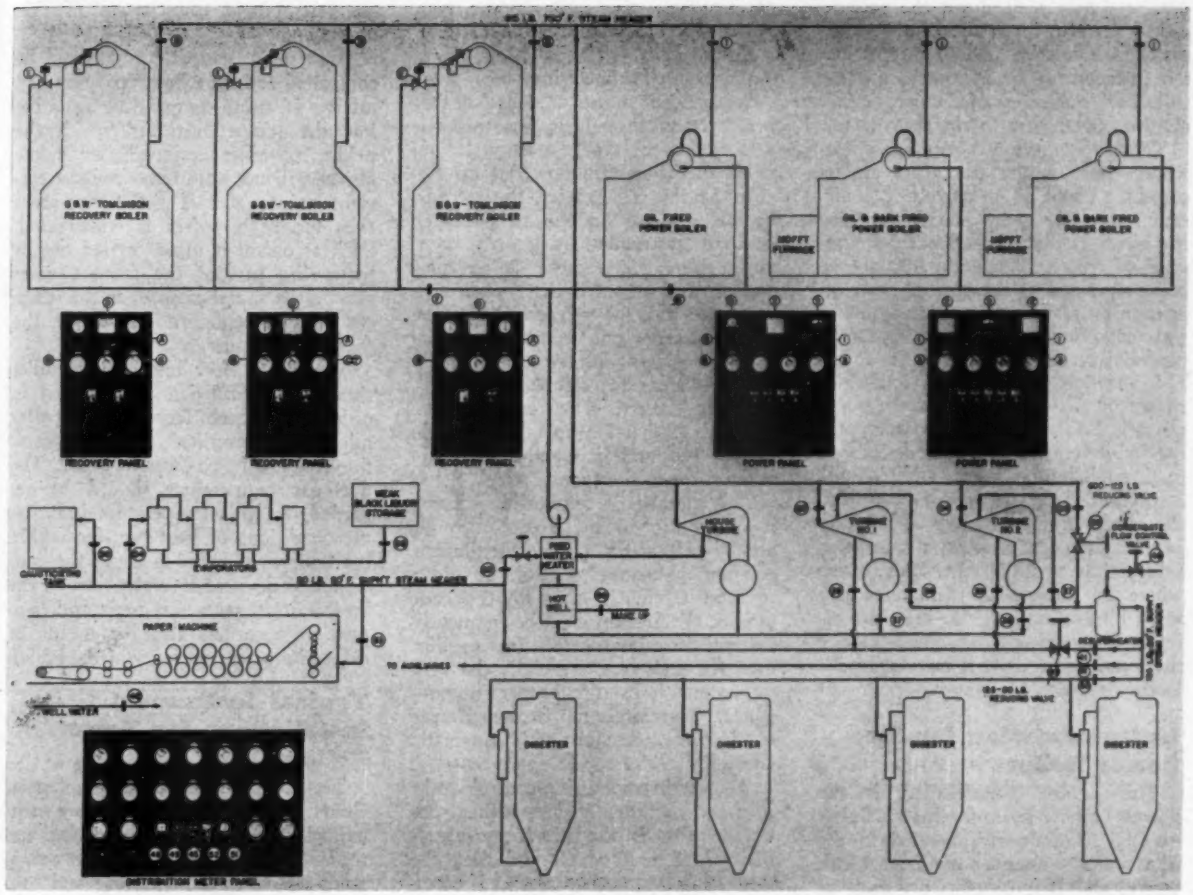
Too much "excess" air, though, must be avoided for the sake of economy. Unnecessary excess air takes B.t.u.'s from the furnace gases to heat it up until the mixture has reached a temperature equality. This makes the temperature potential, or the heat available, of the gases lower. At the same time, the greater the total air, the faster the gases will rush past the tubes, giving less time for heat transfer. These two factors add: first, less heat available, and second, less of that heat available being transferred. Sum: lost heat. In order to make up for the lost heat, the rate of combustion must be raised. Result: coal burned that might have been saved if the excess air had been at a lower value.

There are also limitations as to how far the excess air may be decreased. When unburned fuel or unburned gases appear, the excess air has been cut down too much. Unburned fuel means, of course, a serious fuel loss in the form of carbon to the ash pit or in the fly ash, or in the form of oil vapor. Unburned gas, in the form of CO, means a loss of combustion efficiency. Each pound of carbon burned to $CO_2$ generates 14,540 B.t.u.'s, while the same amount of carbon burned to CO generates only 4,380 B.t.u.'s resulting in a loss of 10,160 B.t.u.'s, or a loss of 60 per cent of the available heat.

When the excess air is cut down, there is a smaller amount of air to heat, and the furnace temperature is raised. Unless modern watercooled walls are used, the high furnace tem-



Recovery boiler panel installation at Union Bag & Paper Corp., Savannah, Georgia.



**Diagrammatic layout of metering and control equipment in the St. Joe Paper Company power plant, Port St. Joe, Florida. (Key to diagram below.)**

### POWER BOILERS

1—Boiler Meter—indicates, records and integrates steam flow, records air flow, records superheated steam temperature.

2—Multi-Power Gauge—indicates preheater inlet air pressure, preheater outlet air pressure, furnace draft, uptake draft, preheater outlet draft.

3—Recorder—records flue gas temperature preheater inlet, flue gas temperature preheater outlet and air temperature preheater outlet.

4—Panel Boards.

### MASTER

5—Master Steam Pressure Recorder-Controller—records steam header pressure, also records feed water pressure.

6—Feed Water Meter—records and integrates feed water flow to power boilers, also records feed water header temperature.

7—Feed Water Meter—records and integrates feed water flow to recovery boilers.

8-22—Complete Combustion Control.

### RECOVERY BOILERS

A—Black Liquor Boiler Meter—indicates, records and integrates black liquor flow, records air flow, records black liquor nozzle supply pressure.

B—Steam Flow Meter—records and integrates steam flow, records heated air temperature, records exit gas temperature.

C—Recorder—records steam pressure, steam temperature and feed water temperature.

D—Multi-Pointer Gauge — indicates forced draft, furnace draft, differential through boiler, differential through air heater, induced draft fan inlet.

E—Thermo-Hydraulic Feed Water Regulator.

F—Automatic Furnace Draft Control.

### DISTRIBUTION METERS

23—Fluid Meter — records and integrates steam supplied to Turbine No. 1, also records steam pressure and temperature.

24—Fluid Meter — records and integrates steam supplied to Turbine No. 2, also records steam pressure and temperature.

25—Fluid Meter — records and integrates steam supplied to main pressure reducing valve.

26—Fluid Meter — records and integrates steam extracted from high pressure tap of Turbine No. 1, also records steam pressure and temperature.

27—Fluid Meter — records and integrates steam extracted from high pressure tap of Turbine No. 2, also records steam pressure and temperature.

28—Fluid Meter — records and integrates steam extracted from low pressure tap of Turbine No. 1, also records steam pressure.

29—Fluid Meter — records and integrates steam extracted from low pressure tap of Turbine No. 2, also records steam pressure.

30—Fluid Meter — records and integrates steam supplied to the four digesters.

31—Fluid Meter — records and integrates steam supplied to the auxiliary header.

32—Fluid Meter — records and integrates steam supplied to the feed water heater.

33—Fluid Meter — records and integrates steam supplied to the paper machine.

34—Fluid Meter — records and integrates steam supplied to the evaporator.

35—Fluid Meter — records and integrates steam supplied for causticizing.

36—Fluid Meter—records and integrates rate of flow of boiler feed make-up water.

37—Fluid Meter—records and integrates flow of condensate from No. 1 surface condenser, also temperature.

38—Fluid Meter—records and integrates flow of condensate from No. 2 surface condenser, also temperature.

39—Fluid Meter—records and integrates rate of flow of weak black liquor, also temperature.

40—Fluid Meter—records and integrates flow of well water.

41—Fluid Meter — records and integrates steam supplied to 125-50 lb. pressure reducing valve, also records steam pressure.

42—Main Panel Board.

### PROCESS CONTROL EQUIPMENT

43—Desuperheater with Steam Temperature Control.

44—Recorder-Controller — records desuperheater steam temperature at inlet and outlet.

45—Hand-Automatic Selector Valve for condensate flow control valve.

46—Diaphragm-Operated condensate Flow Control Valve.

47—Interlock in Temperature Recorder-Controller which automatically closes Main Pressure Reducing Valve if temperature of desuperheated steam becomes excessive.

48—Pressure Controller for Main Steam Pressure Reducing Valve.

49—Hand-Automatic Selector Valve for Main Pressure Reducing Valve.

50—Main Steam Pressure Reducing Valve (600 to 125 lb.)

51—Pressure Controller for 50 lb. Steam Header.

52—Hand-Automatic Selector Valve for 125-50 lb. steam pressure reducing valve.

53—Steam Pressure Reducing Valve (125-50 lb.)

peratures may melt down the refractories, resulting in serious outage and costly maintenance. Another result of too little excess air is smoke, a considerable nuisance of which communities are trying to rid themselves.

Therefore, there is a medium point where the quantity of excess air is correct. There is a correct fuel-air ratio curve for every boiler, depending upon its design, fuel burned, and state of repair. When the furnace is being operated at the correct ratio, it is running at its safest, most economical condition, and at its greatest potential capacity.

Infiltration, an uncontrollable source of air, tends to upset the fuel-air ratio balance. In order to keep any inevitable infiltration that finds its way in through burner inlets, ash pit, and inspection doors as low as possible, the draft in the furnace should be kept constant, as near to atmospheric pressure as possible. In some cases, where the furnace has plain refractory walls infiltration helps to keep the refractories from melting down. Under these conditions draft is increased with load.

## Instrumentation for the Power Boiler

First under consideration is the power boiler. In order that a boiler may be continuously operated in the most efficient manner consistent with safety, and that its efficiency may be checked, the following meters and controls are essential:

a) Meter recording steam pressure and feed water pressure.

b) Meter recording and integrating steam flow, recording air flow, and recording flue gas temperature.

c) Meter recording and integrating feed water flow and recording feed water temperature.

d) Meter recording boiler drum water level.

e) Meter recording steam temperature at superheater outlet.

f) Draft gages.

g) Meters recording temperatures of air and flue gas entering and leaving preheater, water and flue gas entering and leaving economizer.

h) Automatic combustion control system.

i) Automatic feed water control.

j) Automatic steam temperature control.

Probably the most important guide for boiler operation is a meter that records, or at least indicates, the steam pressure. It is the duty of the fireman to maintain a constant pressure throughout load changes. He may do this by manually controlling the fuel and the air, but, without some means of indicating or recording their respective rates, the ratio of the two maintained could never be better than a good guess. That, in itself, is a prime reason for metering.

An excellent means of denoting the correct ratio through instrumentation is to record the air flow through the boiler and the steam flow out of the boiler by the same meter, the recording being done on the same chart. Such an instrument is known as a boiler meter. The meter is so constructed and adjusted that, when the ratio is correct, the two recording pens are coincident, one upon the other. A simple inspection by the fireman shows whether his combustion conditions are correct. The reasoning behind this is that the operator will adjust his fuel and air together to maintain the steam pressure.

This method of combustion control is far superior to the "guess" method, but it still carries with it the human equation in manual control. In order to most efficiently maintain the conditions, the fireman must be frequently manipulating his controls, leaving him time for little else, especially the very important tasks of proper maintenance. Thus, it is much more simple to do the same job with automatic control.

Automatic combustion control works in the same order as does manual operation, that is, the steam pressure is maintained first of all and then the ratio of fuel to air is corrected if necessary. When the steam pressure increases or decreases with a fall or rise in load, the fuel and air are adjusted simultaneously to bring the steam pressure back to the desired condition. After this first adjustment, either the fuel or the air, depending upon the control system, is readjusted so that the steam flow and air flow pens in the boiler meter stay in coincidence. A second readjustment maintains the desired furnace draft in the boiler at every load.

Often considered of equal importance with combustion control is feed water control. Feed water control should supply water to the boiler in the same proportion that steam is leaving, and, in the same operation, maintain a safe water level in the boiler drum.

If the level should become too high, there is danger that slugs of water may be carried over into the superheater and prime mover causing serious damage; and if the level is too low, the tubes may be burned. Such a control is carried out by adjusting the feed water flow in accordance with changes in the steam flow and by re-adjusting it in accordance with the boiler drum water level. Meters for steam flow, feed water flow, and the water level are essential in the control of this operation.

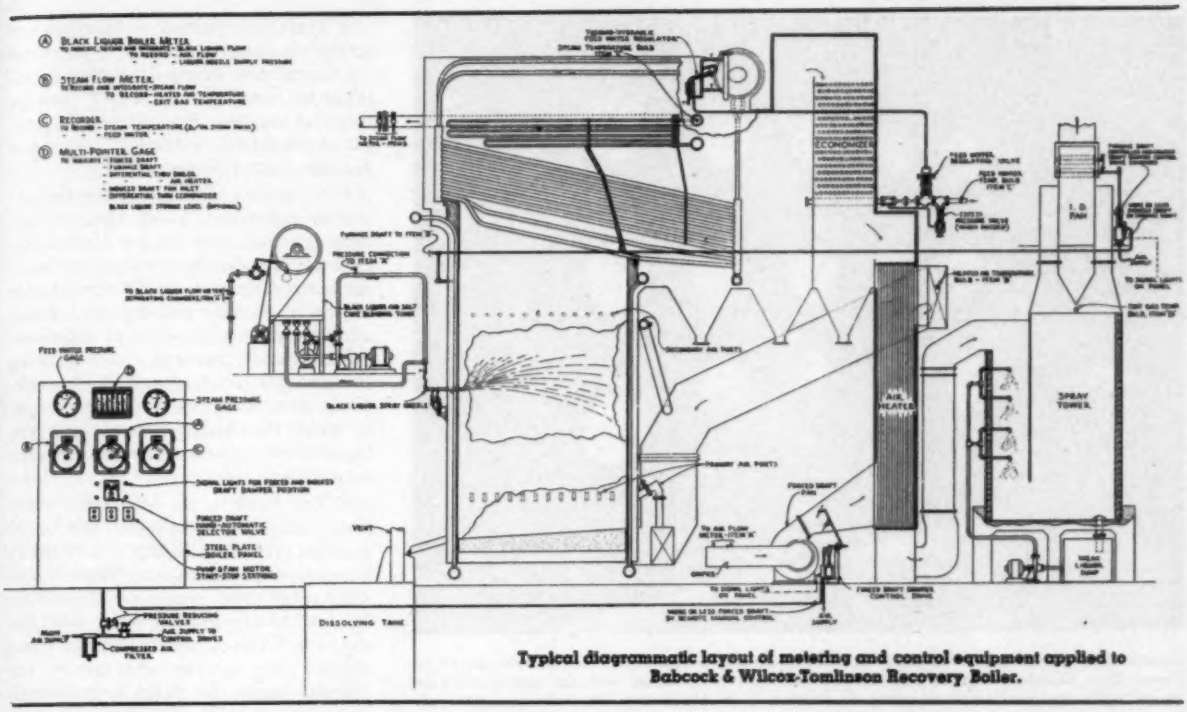
High steam temperatures should be controlled to insure both economy and safety. If steam temperature falls below the temperature for which the prime mover is designed, the prime mover will not operate at its most efficient point; and if the temperature rises too high, safety is endangered. Such a control is often carried out by by-passing part of the furnace gases around the superheater when the steam temperature tends to rise above the desired maximum.

The steam flow out of the boiler should be recorded and integrated in order that the efficiency of the boiler might be determined continually and the load and its changes recorded. The flue gas temperature should be recorded, for this temperature indicates the conditions of heat transfer within the boiler. In order to check the condition of draft at several points in the boiler, draft gages are used; and temperature recorders afford a means of determining the efficiency of the boiler.

## Typical Instrument Installations for Power Boilers

The Container Corporation plant at Carthage, Indiana, was operating manually in 1936, when the decision was made to replace some obsolete equipment and to install metering and control equipment. There is now, on a boiler panel board, an illuminated pressure gauge; an ammeter and a kw. meter; a multiple pointer draft gage to indicate windbox pressure, furnace draft, draft entering and leaving the economizer; a recording pressure gauge for steam and boiler feed pressure. There is an air flow-steam flow meter, and a six-point potentiometer recording temperature of water entering and leaving the economizer, flue gas entering and leaving the economizer, saturated and superheated steam temperature, besides combustion control dials and adjustments, and control buttons for induced and forced draft fans. The combustion control equipment automatically controls the forced draft and uptake draft fans. Provision has been made for future fuel control with air ratio adjustment.

Without a doubt, the new and replaced boiler equipment and auxiliaries brought about a great deal of the economy experienced by this plan, but the new metering and controls that enabled the operators to work the boilers more efficiently helped immeasurably, too. The savings effected in 1937, after allowing for depreciation on the new investment, taxes, insurance, etc., were approximately $50,-




**Typical diagrammatic layout of metering and control equipment applied to Babcock & Wilcox-Tomlinson Recovery Boiler.**

000.00, representing a reduction of $1.64 in the cost of power and steam per ton of products. Keeping up the daily average production, the hourly steam requirements were reduced from about 80,000 pounds to 59,000 pounds.

The boilers in the plant of the St. Joe Paper Company, Port St. Joe, Florida, are provided with boiler meters to indicate, record, and integrate the steam flow, record the air flow to the furnaces, and record the temperature of the superheated steam. Multi-pointer gages indicate the preheater inlet and outlet air pressures and the furnace, uptake, and preheater outlet drafts, while recorders register the flue gas temperatures at the preheater inlet and outlet and the air temperature at the preheater outlets. A feed water meter records and integrates the water supply to the power boilers and records the feed water header pressure. The complete combustion control system consists of a master steam pressure recorder-controller to hold the main steam header pressure constant, a steam flow-air flow boiler meter to maintain combustion economy, and an automatic furnace draft controller.

The feed water is controlled by a feed water regulator.

On both of these installations, compressed air-operated controls are used.

## Instrumentation for Recovery Boilers

The application of metering and control to the black liquor burning recovery boiler represents a slightly different problem. This is due to the fact that the fuel (black liquor) adds a new metering problem to those experienced in a boiler burning the usual type fuel. In the main, the metering and control for the recovery boiler is the same as that for the power boiler, with the following exceptions:

a) Black liquor boiler meter, recording and integrating black liquor flow, recording air flow, and recording black liquor nozzle supply pressure.

b) Meter recording and integrating steam flow and flue gas temperature.

c) Meter recording and integrating weak black liquor flow.

d) Black liquor storage level indicator in multi-pointer gauge.

e) Meter recording and integrating green liquor flow.

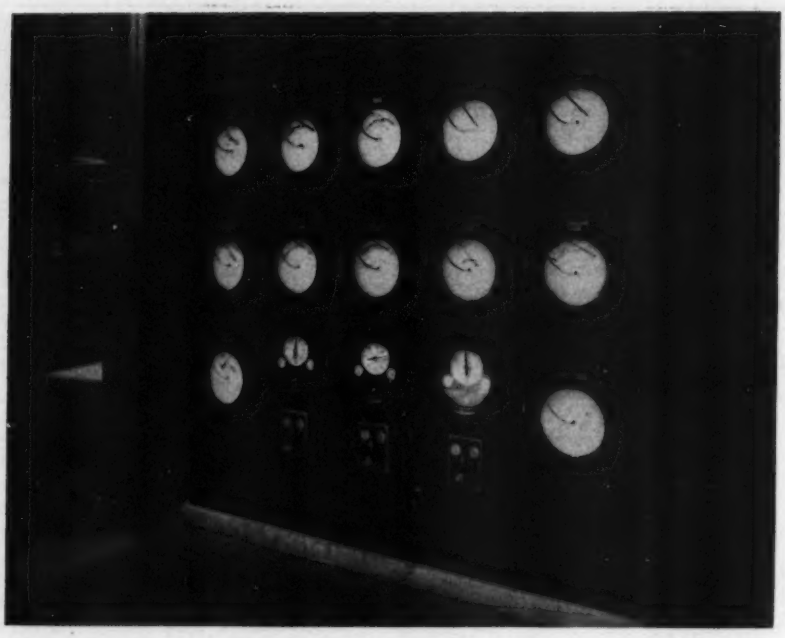
The control of the typical recovery boiler is essentially the same as that of the power boiler in that the fuel and air are adjusted in accordance with changes in load as indicated by variations in steam pressure, and the air flow is readjusted to maintain the correct fuel-air ratio at every load. However, the boiler meter used in this case is different from the type installed on the power boilers since it is a fuel flow-air flow meter instead of a steam flow-air flow meter. The steam flow-air flow meter is impractical for use with a recovery boiler, due to the dropping of char from the furnace walls to the hearth.

The black liquor boiler meter measures the supply of black liquor to the blending tank. As the blending tank is merely a reservoir of small capacity, this flow measurement gives the actual supply of black liquor to the unit. By measuring the flow to the blending tank the difficulty encountered by suspended salt cake in the line from the tank to the spray nozzles is avoided.

The air flow through the boiler is controlled by regulating the forced draft damper manually from a remote manual relay on the panel board. The average analysis of the black liquor being known, a chart is set up for the operator that shows the amount of air necessary with any given amount of black liquor of given density to maintain the desired combustion conditions. The operator takes a sample of the heavy black liquor periodically during normal operation, determines the concentration, and sets the air control as indicated on the chart.

As in the power boilers, the recovery boiler furnace draft conditions are maintained constant at a slight suction by the regulation of the induced draft dampers which are automatically operated from the furnace draft control. This insures maintenance of the air flow established by the operator because it allows for any change in resistance across the heating surfaces due to the building up of solid matter on tubes.

The steam flow meter is necessary for checking the efficiency of the unit and to record the variations of load. A flow meter is utilized to measure the weak black liquor from the weak liquor storage to the evaporators. The black liquor storage level is indicated on a multi-pointer gage. Sometimes



**Distribution Meter Panel installed in the Container Corporation of America plant at Fernandina, Florida. Reading from left to right, top row to bottom row, the meters measure steam to the desuperheater, steam to the turbine, 50-lb. bleed from the turbine, condensate from the turbine, steam to the feed water heater, steam to the digesters, steam to the evaporators, steam to the pulp machine, steam to the causticizer, mill water supply, and steam to the yard. The bottom meter at right measures the fuel oil tank level, and the three controllers at the bottom regulate the 125-lb. steam pressure reducing station, the desuperheated steam temperature, and the 50-lb. reducing steam pressure station.**

it is considered necessary to install a recording and integrating meter for measuring the flow of green liquor from the dissolving tank to the green liquor storage tank. This record completes the data necessary for calculating the chemical efficiency of the unit, since the specific gravity and temperature of the green liquor are observed and tabulated at regular frequent intervals, and the amount of salt cake added to the black liquor in the mixing tank is also accurately weighed. A composite sample of green liquor obtained from hourly samples is analyzed daily for determining the chemical composition of the green liquor.

This may result in a large saving in salt cake, as, on a similar installation in the Canada Paper Company, the amount of salt cake per ton of pulp that had to be added was reduced from approximately 400 pounds to 230 pounds, making a saving of about $136.00 per day.

## Metering for Steam Distribution

Not only has it been found economical to install instrumentation on the boilers, but also it has been deemed practical to install meters to measure the distribution of steam from the boilers to processes in the plant, such as, steam supply to the main pressure reducing station, to the digesters, to the evaporator, to the feed water heater, to the pulp dryer, and for causticizing.

At the St. Joe power plant, flow meters record and integrate the steam supply to the main pressure reducing valve; the steam extracted from the turbine at 125 pounds from the high pressure service taps and at 50 pounds from the low pressure taps; the supply of 125-pound, 50-degree superheat steam to the plant; the steam supply to the feed water heaters; and the 50-pound, 50-degree superheat steam supplied to the paper machines, evaporators, and causticizing tank of the chemical recovery plant. The reasons for measuring the flow of distribution steam are for purposes of accounting and process control. Often a controller is incorporated in the flow meter to automatically operate the process.

To obtain uniformity of products, minimum steam consumption, and maximum yields when cooking pulp, the operators endeavor to maintain a certain definite relation between time, temperature, and pressure for the particular wood and liquor strength being used. In digesters without forced circulation, spot temperature measurements are not representative of the temperature of the whole mass, and the use of the steam flow meter as a guide in cooking in addition to the conventional pressure and temperature measurements becomes of prime importance. In fact, automatic temperature and steam flow recorder-controllers are becoming almost standard equipment for the purpose of regulating the B.t.u. input uniformly from cook to cook in accordance with predetermined templates calculated to develop the proper average temperature curve.

On digesters with forced circulation, similar equipment is of equal value, although the same results can be obtained automatically by working from the temperature. A definite knowledge of the steam flow and the total steam admitted is of great value in determining the most desirable cooking curve for any given wood and acid condition, since comparisons can be made between the physical tests and the bleachability produced under different steam flow curves.

When there is no automatic steam flow input control, the steam flow curve is often very illuminating as to what is happening in the digester. Insufficient side relief may result in alternating "gulps" of dry and wet relief from the top relief valve, and, when on hand control, the varying pressure in the digester causes the steam flow through any given hand valve setting to vary widely. Likewise during the early stages of the cook, variation in the mechanical resistance at the point of steam admission may cause a similar variation in steam flow. Automatic control overcomes these conditions, although the main reasons for automatic control of steam input are improvement in uniformity, steam savings (as high as 10 per cent have been experienced at some mills), and increased yield with corresponding decrease in chemical consumption in the acid making plant.

The steam to the digesters is measured essentially because the digesters are large steam consumers and a knowledge of the cost of this steam per ton of pulp is of great assistance in endeavoring to cut costs. In some mills where different types of pulp are produced in different digesters, meters on the individual digesters provide cost figures for the various types of pulp or the same type of pulp from different woods. In kraft mills, where the digesters are generally smaller and the rate of temperature rise does not affect the pulp, the operators take the temperature up as rapidly as possible to a maximum and then decrease the flow to maintain the maximum temperature. The difference in the grades of wood used is not so pronounced. Thus one steam flow meter is generally used for the whole battery of digesters, primarily for cost purposes.

The measurement of steam used at the dry end of paper machines gives a continuous check on the efficiency of the drying and draining system of the paper machine and reflects the effect

of variations in the operation of the air conditioning equipment or the improper operation of any automatic temperature control equipment which might be installed. Measurement of the auxiliary steam used around paper machines is equally important in that numbers of cases have occurred where consumed steam has attained unreasonable proportions through improvident use, leaking traps and other defective equipment. Recently, in one Canadian mill, the practice had been to introduce carelessly a considerable amount of steam at the wet end of paper machines in an effort to keep down slime. Meters were placed in the line and the saving made in steam consumption amounted to approximately $120 per day. Paper machines are large steam users and different grades of paper will require different rates of flow to maintain the proper dryer temperature. Flow meters, then, on lines to individual machines, besides providing cost figures for the different grades of paper, indicate the correct flow for each grade.

Steam to the black liquor evaporators is measured primarily for cost distribution. When the flow of the weak black liquor to the evaporator is recorded, a cost figure per unit of black liquor evaporated may be attained. Also, the meter is often desirable for operating purposes in showing up inefficiency. The concentration of liquor by steam is a relatively expensive process and, when the steam to the evaporator is excessive, the same work might be accomplished by means of waste heat.

Measurement of steam in most plants to the causticizing tanks or to the weak black liquor storage is made primarily for cost distribution.

With good orifice locations, the flow meters measuring steam, water, and air distribution can be expected to be accurate to within 2 per cent over the upper 75 per cent of the meter range. When a metering system is being considered, the orifices should be located in a preliminary piping layout plan, and then the locations should be checked by the engineers of an experienced manufacturer before the final layout is made.

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## CORRECTION

▸▸▸ IN AN ARTICLE "Important Properties of Electrical Insulating Papers," by Dr. H. H. Race, R. J. Hemphill, and H. S. Endicott, which appeared in THE PAPER INDUSTRY AND PAPER WORLD, November, 1940, the last paragraph under side heading "Test for Sulphates" on page 794 should have read:

"It is estimated roughly that NDA (no detectable amount) corresponds to approximately 6 ppm of chlorides and 60 ppm of sulphates in the dry paper."

# *Welding* in Paper Mill Maintenance and Construction

**HERMAN A. YARGER, Master Mechanic**
**River Raisin Paper Company**

▸▸▸ WELDING, both oxyacetylene and electric arc, also the cutting torch and cutting machine, has won an indispensable place in maintenance and construction work in the paper industry. So unlimited are welding possibilities in the industry, that welding equipment may be placed at the head of the first-aid list in the maintenance department.

Not only has welding made it possible to reclaim broken or worn machinery parts; but it also has furnished a rapid and economical means for replacing or repairing pipe lines which sometimes fail at a very critical production period.

The fabrication of a piping system is one of the most important welding applications. When used for this purpose, welding permits the elimination of expensive fittings which are often difficult to obtain on short notice.

Another application for welding which is rapidly gaining recognition is the fabrication of structural steel shapes and plates into machine bases and parts. Used in place of cast iron, these steel bases and parts minimize the possibility of failure.

In many cases, bronze welding and surfacing may be employed to repair cast iron pulleys, gear arms, gear teeth, and other machine parts where it would be a disadvantage to dismantle a machine to make a repair. Oftentimes, the repair can be made with little or no preheating.

When it becomes necessary to make alterations or additions to mill and factory buildings of steel construction to accommodate the installation of new equipment or the rearrangement of present equipment, the cutting and welding process must be considered advantageous from nearly every standpoint. Among its advantages in such work would be the elimination of the old method of bolting and riveting and the noise incident to it.

Upon the welder, the man who handles the equipment and actually does the work, rests the responsibility of successful welding. Therefore, he must be conversant with the details of his occupation, both technical and practical.

Industry and educational institutions have been alert to the advantages of welding. As a result, courses of study have been developed in an effort to elevate the standard of efficiency of men engaged in this occupation. Likewise, the government now is active in a movement to establish schools of instruction in certain industrial sections.

The cost of equipment necessary to handle the various paper mill maintenance and construction jobs of welding and brazing represents a small investment, the advantages of which are so great that any executive should be quick to recognize the wisdom of incorporating the welding process in his plant. In case of doubt, a fair trial would be most convincing.

# Don't Overload Your Slings!

F. L. SPANGLER, M.E.

▸▸▸ THE SLING IS the connecting link between the crane hook and the load to be lifted. As such, it deserves as much care and attention as the crane ropes—in fact even more, since it is subjected to much more abuse.

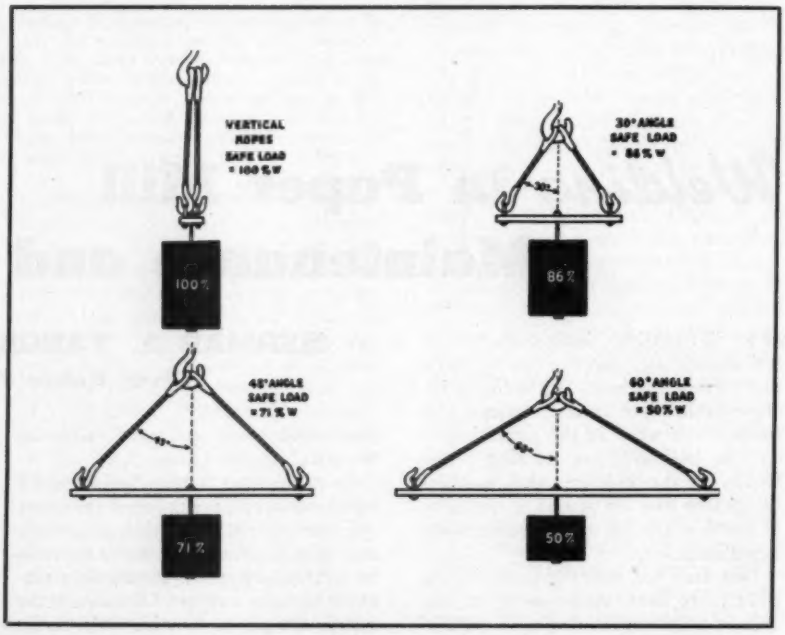
If slings are to handle loads with absolute safety, the rigger must give due consideration to the condition of the sling and to its angle of repose, both of which affect the sling's lifting capacity.

In the interest of safety, slings should be inspected regularly for kinks, dog-legs, high strands, broken wires and strands, and other evidence of a weakened condition. To prevent kinks, riggers should be particularly careful that all curls and loops in the legs of the sling are straightened out before the load is lifted. A serious disadvantage of wire rope slings used to be their tendency to loop and kink; they were cranky and hard to manage, and it was not unusual for the riggers to spend considerable time untwisting and straightening out the various parts of the sling before it could be hitched to the load.

To avoid these troubles, many slings being used today are made of preformed rope, which is characterized by wires and strands that are preshaped to their final helical form and therefore do not try to spring apart and distort from their true helical shape. Preformed rope slings handle much like slings of Manila rope. They actually resist curling and looping and pulling into kinks. Their use has greatly increased sling life and has reduced the rigger's time when making hitches.

The safe lifting capacity of a sling is affected not only by kinks and broken wires, but also by the angle of repose that the sling assumes when lifting the load. The more the sling departs from a true vertical position, the greater is the stress produced in the sling by a given load. When this angle becomes 60 deg., the lifting capacity of the sling is only half what it is when the sling is vertical.

The effect of the angle of repose on the capacity of the sling can be shown by a simple demonstration. Take a 3 or 4 ft. length of string, and tie each end securely to a nail. Then drive the nails close together in a plank. Hooking your finger through the bight of the string, try to break the string by pulling on it. If you don't succeed, separate the nails as far apart as the string will allow, so that the string is stretched tight between the two nails. Hook your finger over the center of the string and give a lateral pull in order to deflect the string as much as possible. Now the string breaks easily. Why? Because a load of this kind applies a deflecting force to the string, in addition to the loading that a straight pull gives. Hence, the load on the string is increased and is the resultant of these two forces. Now experiment with the nails at different distances apart, and you will notice that the more slack the string has, or the closer the string coincides with the direction of pull, the greater a pull it will stand before breaking.




The relative safe loads for a vertical sling and slings at angles of 30, 45, and 60 degrees with the vertical are illustrated in the accompanying diagrams.

In many cases unsymmetrical loads are not evenly balanced between the various parts of a bridle sling; therefore the legs of the sling do not have the same angle of repose. For example, if the attachments at the ends of a two-leg sling are hooked onto the ends of a cast-iron pipe, the sling leg attached to the bell end of the pipe will not be deflected as much from the vertical as will the other leg, since the bell end weighs more than the other end of the pipe; therefore the leg supporting it must carry a greater load than the other end.

Where sling legs have different angles of repose, the leg that is nearest to vertical is carrying the greatest load; therefore if calculation shows that the stress in this leg is within the safe load requirements, one can be assured that the other legs of the sling also do not exceed these requirements. Rather than go through elaborate calculations to determine what proportion of the load the highest-stressed leg is carrying, one is justified in assuming that it carries all the load, and then, knowing the angle of repose, one can determine whether the sling is of sufficient size to come within the safe load requirements. Such a calculation will always be conservative, since it will always allow a somewhat increased factor of safety.

Where two individual slings are employed as bridle slings, the crane hook can be passed through the eye of each, provided the angle between the slings is small, when the load is suspended. If this angle is large, the sling should be suspended from the crane hook by a ring or link which passes through the eyes of both legs of the sling. With this arrangement, there is no tendency to spread the hook.

# PAPER SKETCHES

45 PAPIER MACHÉ TENTS WERE USED IN 1900 TO HOUSE 500 CONVALESCENT PATIENTS OF A HOSPITAL IN NETLEY, ENGLAND.
NEARLY 52% MORE WOODPULP WAS PRODUCED IN THE U.S. IN 1940 THAN IN 1938. PRODUCTION FOR 1938 TOTALLED 5,933,560 TONS; FOR 1940, 9,007,000 TONS (ESTIMATED)
DURING THE 1880'S, AN ORGAN WITH 1400 PAPER-PULP PIPES WAS MADE BY A MONK IN ITALY.
SO SCARCE WAS PAPER DURING THE AMERICAN REVOLUTION THAT THE WIDE MARGINS OF JOURNALS OF THE BRITISH HOUSE OF COMMONS, DATING FROM THE DAYS OF CROMWELL, WERE USED BY ONE COMMANDING OFFICER OF THE AMERICAN ARMY FOR HIS MESSAGES.

Originally, boilers in this steam plant were served from the ground floor. Then demand jumped. Additional boilers (plus a plant addition) were considered. The other way was to excavate under existing boilers and thus increase fire box size, heating surfaces, steam capacity. But that raised the problem of removing ashes from the newly-created basement.

This inexpensive Reading Electric Hoist solved the problem in the most economical way. Plant manager states, "Never a repair."

The illustrated book suggests equally satisfactory answers to 144 hoisting problems. Write for your free copy.

READING CHAIN & BLOCK CORP.
DEPT. 43 READING, PA.

READING
Chain Hoists, Electric Hoists,
Cranes and Monorails

# ALLIED

## NEW BEARINGS PLANT FOR MUSKEGON, MICH.

A. H. Frauenthal, vice president and general manager of the Bantam Bearings Corporation, South Bend, Indiana, resigned from the company on May 1. Mr. Frauenthal is leaving to establish a new factory in Muskegon to manufacture large special roller and ball bearings, as well as aircraft parts so badly needed for National Defense. During recent months in conjunction with defense activities, Mr. Frauenthal has been acting as consulting engineer for other manufacturers in getting them started on defense contracts. An outstanding authority on the design and manufacturing methods required on this new and extremely difficult type of work, he has been urged to develop additional plant facilities to help take care of the present emergency.

The new factory, the name of which has not as yet been announced, will be located at Muskegon, Michigan, where a plant of 135,000 square feet has been purchased. Employment of 500 to 600 men is contemplated when full production is achieved.

Mr. Frauenthal has been with Bantam since 1930, and for the past five years has occupied the position of vice president and general manager. Under Mr. Frauenthal's management, the plant has been expanded three times, more than doubling its normal output exclusive of the large amount of defense work which has been added recently. Bantam is now employing approximately 600 people.

Previous to becoming associated with Bantam, Mr. Frauenthal occupied responsible positions with General Electric Company, Chandler Motor Car Company, and The Studebaker Corporation. Mr. Frauenthal is the author of a number of technical papers and holds many patents on anti-friction bearings and on an outstanding precision measuring instrument.

Associated with him in the new company will be H. H. Brooksieker, Cleveland, an associate of over twenty years, who will be vice president in charge of manufacturing; and F. J. Donovan of Chicago, formerly well-known in South Bend, as treasurer of Bantam.

Mr. Frauenthal's successor, R. B. Nichols, who has been secretary and sales manager, as well as assistant to Mr. Frauenthal, has been with Bantam for a number of years. He was originally associated with Bantam before it moved to South Bend in 1928. He has had long experience with the problems of the company and is thoroughly familiar with the executive details of the corporation.

For the next several months, while the new plant is being equipped, Mr. Frauenthal will act as consultant to the new Bantam management, dividing his time between South Bend and Muskegon.

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▶▶▶ A NEW TYPE of carton stitching equipment has been announced by the Acme Steel Company, Chicago. This new equipment, known as a Silverstitcher, is said to incorporate several features unique in the field among which is a special single pedal control which is adjustable and reduces the manual effort required for stitching by 50 per cent. There are only a few moving parts and they are reversible to cut down maintenance costs. It was also announced that this new machine is available at low cost on a suitable purchase plan.

Acme "Silverstitcher"

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▶▶▶ A RECENT ANNOUNCEMENT disclosed that the W. H. & L. D. Betz Company have moved the entire organization into new and larger buildings. The new address is Gillingham and Worth Streets in Frankford, Philadelphia. The change was necessitated because of large increase in the volume of business. It was also stated in the announcement that the laboratory space had been increased to five times what it formerly

was, the office facilities were increased more than four times, and the manufacturing and formulating departments about three and one-half times.

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▶▶▶ AN INTERESTING FEATURE ARTICLE on the subject of cleaning and reclaiming rope has been printed in the March-April issue of the Oakite News Service, the house organ published by the Oakite Products, Inc., New York. The article describes an improved washing procedure which, due to providing a complete removal of oil, grease and dirt deposits from rope strands, enables a mill to substantially increase the tensile strength of the finished paper, and also to improve product appearance.

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## GOODRICH COMPLETES $300,000 PLANT

A new $300,000 manufacturing plant has recently been completed by the B. F. Goodrich Company, Akron, Ohio, for processing products from Koroseal, the synthetic rubber. This addition to the already vast facilities of this company for the manufacturing of this new product climaxes a program of capital outlays in excess of $1,000,000.

The new plant is located at the main factories of the Goodrich Company and will augment present production facilities in the treating of fabrics, manufacture of cements and lacquers, and will iniate production of a special film for packaging materials and for general industrial use.

The Koroseal film which will be manufactured in the plant is the newest adaptation of the material. For various reasons, such as its chemical inertness, resistance to flame, and electrical properties, the new film is expected to have wide application for industrial use and in the expanding packaging field.

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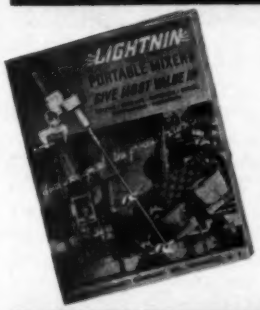
▶▶▶ A NEW BOOK entitled "Dyes Made In America" has just been published by the Calco Chemical Division of the American Chemical Cyanamid Company, Bound Brook, New Jersey. William Haynes, the former publisher of *Chemical Industries,* has written this new book in a narrative style; beginning the story in 1915, at which time the country was faced with a critical shortage of chemicals and progressing with an accurate and well-written account of the development of the dyes industry in America. This publication should be of particular interest to all American dye users.


# 3 TYPES OF MIXERS FOR DIFFERENT TANK CONDITIONS

## "LIGHTNIN" PORTABLE MIXERS




Easily moved from tank to tank. Gear drive for heavy liquids, direct drive for lighter fluids. These powerful mixers set up a strong top-to-bottom turnover plus a slow rotation. Sizes from 1/4 to 10 H.P. Catalog B-65 describes these mixers.

## "LIGHTNIN" TOP ENTERING MIXERS

While primarily for closed tank and pressure vacuum work, these permanently mounted mixers are frequently used where space restriction prevents the use of side entering mixers on large tank installations. Geared and Direct Drive—1/4 to 15 H.P. Send for Catalog B-68.

## "LIGHTNIN" SIDE ENTERING MIXERS

Invaluable for large tank work, these sturdy mixers are available in four types that meet practically every requirement. Simple and easy to install, these mixers make a substantial saving in current while improving the quality of the mix. 1/2 to 15 H.P. Catalog B-66 describes the line.

*WE DO NOT RECOMMEND "LIGHTNIN" MIXERS FOR STOCK OF A CONSISTENCY HIGHER THAN 2 TO 2½%*

**MIXING EQUIPMENT CO., INC.**

1035 GARSON AVENUE, ROCHESTER, N. Y.

MIXING EQUIPMENT CO., INC. 1035 Garson Avenue, Rochester, N. Y.
Please send me:

_____ Catalog B-65—Portable Mixers
_____ Catalog B-68—Top Entering Mixers
_____ Catalog B-66—Side Entering Mixers

Name.....
Title.....
Company.....
Address.....

# ASSOCIATIONS

## APPA AWARDED HONORS IN TRADE ASS'N CONTEST

A certificate of honorable mention in the American Trade Association Executives' ninth annual competition for outstanding trade association services in 1940 "to members, the industry, and the general public" has been awarded to the American Paper and Pulp Association.

This and other awards in the contest were presented at the annual meeting of the American Trade Association Executives, held April 28 in Washington, by Under-Secretary of Commerce Wayne Chatfield Taylor, on behalf of Secretary of Commerce Jesse H. Jones, who headed the jury which made the selections but who was unable to attend the session.

The American Paper and Pulp Association won its award: "For its achievement in maintaining a program of exceptionally wide scope, which included services to its members and its industry in practically all major fields of trade association endeavor. As a result of the program many problems have been solved through self-regulation and increased industrial efficiency."

First prize bronze medallion award in the competition went to the American Trucking Associations. Other honorable mentions went to the New York Employing Printers' Association, American Meat Institute, Institute of Boiler and Radiator Manufacturers, Institute of Distribution and Rocky Mountain Electrical League.

In addition to Secretary of Commerce Jones the jury of award comprised C. S. Ching, director of industrial and public relations, United States Rubber Company; Edwin S. Friendly, business manager, The New York Sun; Walter D. Fuller, president, Curtis Publishing Company, and head of the National Association of Manufacturers, and Herluf V. Olsen, dean of the Amos Tuck School of Business Administration at Dartmouth College.

Speakers at the annual meeting of the American Trade Association Executives included Senator Joseph C. O'Mahoney, Wyoming Democrat, who reviewed the work of the Temporary National Economic Committee, of which he was chairman, and advocated passage of his measure for federal chartering of interstate corporations. He declared that national regulation and planning was essential to meet the pressing problems of the present national defense emergency, and those which would be presented by the post-war period.

Another speaker was Blackwell Smith, assistant director of the priorities division in the Office of Production Management, who asserted that the United States "cannot have business as usual so long as we must pay first attention to defense needs."

"Actually," Smith told the trade association executives, "we are not literally choosing between guns and butter. But it is true that we are choosing or shortly must choose between some things which are very essential, such as tanks, airplanes and ships, and some things mainly in consumer's durable goods, which are not so essential even though we have been accustomed to them."

## CONVENTIONS AND COMING EVENTS

May 16-17—Spring meeting of the New York-Canadian Division of the Superintendents Association at the General Brock Hotel, Niagara Falls, Ontario, Canada.

May 22—Fourteenth Annual Fox River Valley and Lake Shore Safety Conference, Fond du Lac, Wisconsin.

May 23-24—Spring meeting of the Northwest Division of the American Pulp and Paper Mill Superintendents Association at Marinette, Wisconsin.

May 26-29 — Twenty-sixth Annual Convention of the National Association of Purchasing Agents, Stevens Hotel, Chicago.

June 6-7—Annual joint meeting of the Pacific Coast Division, American Pulp and Paper Mill Superintendents Association and the Pacific Section of TAPPI, at the Portland Hotel, Portland, Oregon.

June 17-19—American Pulp and Paper Mill Superintendents Association, Poland Spring House, Poland Spring, Maine.

Sept. 16-20—Fall meeting of the Technical Association of the Pulp and Paper Industry, University of Michigan, Ann Arbor, Mich.

Sept. 17-19—Annual Conference of National Industrial Advertisers Association, Royal York Hotel, Toronto.

Oct. 6-10—Thirtieth Annual Safety Congress of the National Safety Council, Stevens Hotel, Chicago.

## MICHIGAN SUPTS. HAVE ANNUAL LADIES' NIGHT

Once each year the Michigan Division of the American Pulp and Paper Mill Superintendents Association has a dinner meeting designated as ladies' night. The event is always a gala occasion, but this year those in charge left nothing undone to give the ladies a delightful evening. One of the steak dinners for which the meetings of this association are noted was served, and the dinner, special favors, and all appointments were voted "most excellent" by all present.

The guests gathered early to spend some time at a reception given by the Affiliated Group in the Hotel Club Room just preceding the dinner. Here O. W. Callighan was in charge, and he was indeed a busy but most congenial host. An accordionist entertained during this reception, and by the time dinner was announced, it was a gay, friendly party that filed into the big dining room.

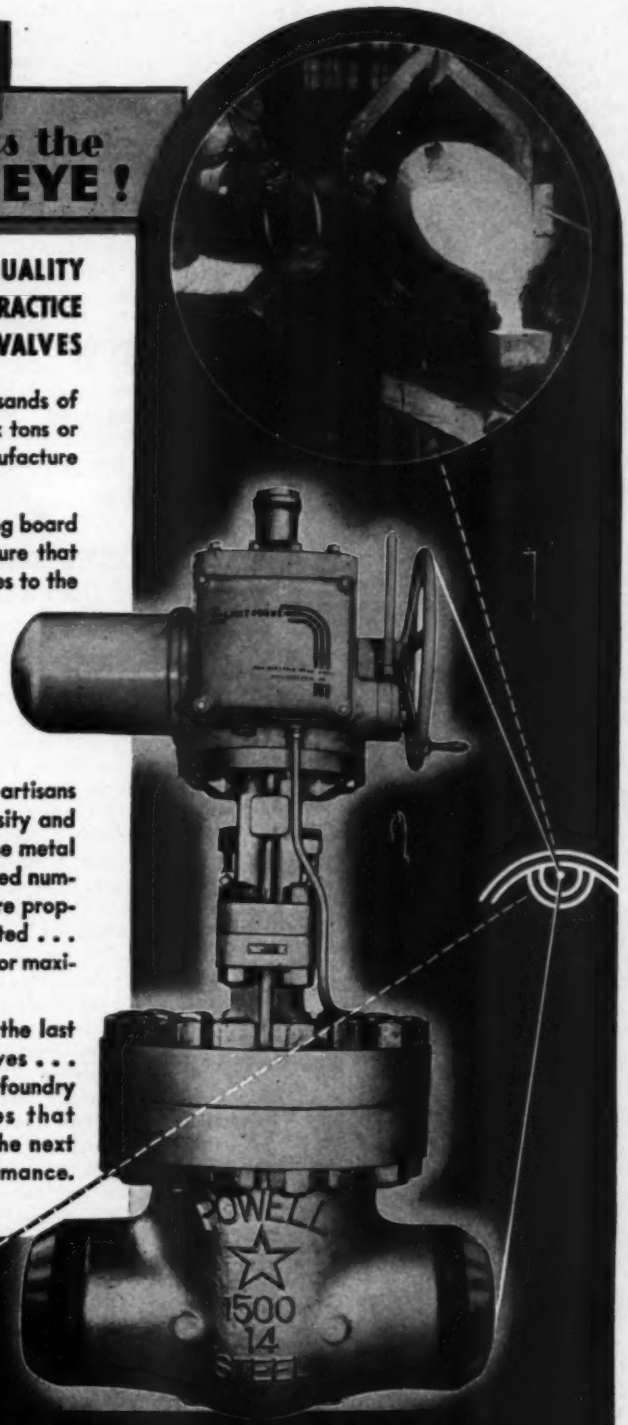
Following the dinner, Frank Eilers, of The Orr Felt & Blanket Co., who acted as toastmaster, introduced a number of guests who were present. Among the visitors at the speakers table were Robert Eminger, secretary-treasurer of the national association, who with Mrs. Eminger had driven 250 miles through the rain to be present.

Also at the head table were past presidents of the Michigan Division and two past national presidents of the Superintendents Association: Roy H. Kelly, of Marathon Paper Mills, Rothschild, Wisconsin, accompanied by Mrs. Kelly, and E. T. Coughlin, of Bryant Paper Company, Kalamazoo. Visitors from Ohio were Claude Sorg, of Sorg Paper Co., Middletown, and Mrs. Sorg.

Door prizes were to be given to the lady and the man who held the lucky number, and the toastmaster asked Homer Stafford (retired papermaker, who is feeling much better after a serious illness) to draw the winning ticket for the ladies' prize. A young lady was asked to do the same for the men's prize.

The toastmaster then introduced Kalamazoo's distinguished paper mill personality—Mrs. Helen King, president of the Rex Paper Company, who, as he put it, "has done an outstanding job of running a paper mill." Mrs. King responded with a few remarks which left the ladies present inspired

# There's more to POWELL QUALITY than meets the BUYER'S EYE!



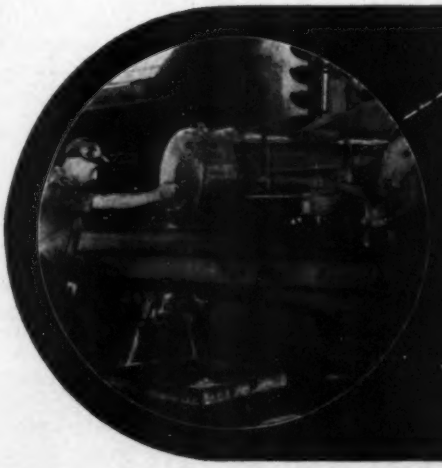

## LARGE VALVES REQUIRE A SPECIAL SET OF QUALITY STANDARDS, SO LET'S INSPECT STEEL FOUNDRY PRACTICE IN THE MANUFACTURE OF POWELL LARGE VALVES

If a valve has to withstand pressures ranging into thousands of pounds . . . if the valve itself may weigh as much as six tons or more . . . then, to be sure, special standards of manufacture have to be followed.

From the first rough sketch on a Powell engineer's drawing board to the finished product, the self-same scientific procedure that distinguishes Powell valve manufacture in general applies to the huge steel and alloy valves needed for high pressure and high temperature service. Designs are checked and double-checked...materials are constantly laboratory tested for strength and durability . . . patterns are carefully made. Then, for the first actual building step —the casting.

Here in the Powell foundry, modern furnaces and skilled artisans combine to produce a valve absolutely free from porosity and sand inclusions. Every step is taken to insure quality. The metal is poured at a specified heat . . . a certain, pre-determined number of hours are allowed for cooling. Gates and risers are properly removed—casting is cleaned, then carefully inspected . . . finally, it's properly heat treated, according to analysis, for maximum physical characteristics and resistance to fatigue.

Then, on to the machining and testing departments for the last operations in the manufacture of large Powell valves . . . operations that verify the labors of the research and foundry departments, and put the final touch on valves that are *"quality through and through."* Consider Powell the next time you specify valves . . . buy value . . . buy performance.



## POWELL VALVES

THE WM. POWELL COMPANY • CINCINNATI, OHIO

**You Need More Than a Photograph of the Finished Product to See ALL the Qualities that Make Powell Valves Uniquely Able to Better Serve the Mill Owner**

that so gracious a feminine personality had achieved such success in business.

The last speaker introduced was Edward J. Thom, manager of pulp sales for the Canada Paper Company and the Howard Smith Paper Mills, Ltd., Montreal. Mr. Thom's quick wit and humorous remarks brought this part of the affair to a delightful climax.

But that was not the end. "Believe it or not," there was a floor show that would have been a headline attraction in many larger cities. There was singing, dancing, and a well-known performer, who, with the aid of a pair of crutches, made everyone realize that handicaps often stimulate one's ambition to excel in something. Few athletes could have given a better or more astonishing exhibition of stunts than did this young man who had lost one leg.

Arnold Weller, of the Sutherland Paper Company, is chairman of the Michigan Division of the Superintendents Association; Henry Nendorf, Rex Paper Company, first vice chairman; Alfred Perlick, Kalamazoo Vegetable Parchment Company, second vice chairman; and Glenn Sutton, Sutherland Paper Company, secretary-treasurer.

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## OPM APPOINTS HERON AND WOLF ON COMMITTEE

Alexander R. Heron of Crown Zellerbach, San Francisco, and Robert B. Wolf of Weyerhaeuser Timber Company, Longview, Washington, are serving as members of the committee of industry consultants appointed in the Labor Division of the Office of Production Management in Washington to help maintain effective industrial relations, avoid industrial disputes, and assist the United States Conciliation Service and other established agencies in the field of industrial relations when the national defense program is involved.

E. D. Brandsome of the Vanadium Corporation of America, Bridgeville, Pa., is chairman of the committee, appointment of which was announced April 26 by OPM Associate Director General Sidney Hillman. Other members include Fred A. Krafft, American Viscose, Wilmington; L. C. Hill, Murray Corporation, Detroit; C. W. Berquist, Western Electric, Chicago; Frank V. Bestrup, Associated Industries of Massachusetts, Boston; E. F. Blank, Jones & Laughlin Steel Corporation, Pittsburgh; G. B. Bogart, Indian Refining Company, Lawrenceville, Illinois; Wade T. Childress, Columbia Terminals Company, St. Louis; James H. Greene, Chamber of Commerce, Pittsburgh; George J. Kelday, International Harvester Company, Chicago; B. D. Kunkle, General Motors Corporation, Detroit; J. H. Madden, American Brass Company, Waterbury, Connecticut; and Dale Purves, John B. Stetson Co., Philadelphia.

"These industry consultants, men from industry, experienced in industrial management," it was announced, "are available to industries engaged in defense work for advice and assistance in arriving at prompt adjustments of disputes without stoppage of work, or in shortening the duration of work stoppages. A parallel service is afforded to labor organizations through the Labor Division's staff of labor consultants. Every effort is being made to secure voluntary agreements of the parties upon questions in issue."

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## CHEMISTS DISCUSS GLASS DEVELOPMENT

The newer developments in plate and window glass manufacture, bottles, illuminating ware, optical glass, fiberglass, and art glass were discussed at a recent joint meeting of the American Section of the Society of Chemical Industry, the New York Section of the American Chemical Society, and the American Institute of Chemical Engineers held in New York City.

The discussion, led by Dr. Alexander Silverman, head of the department of Chemistry at the University of Pittsburgh, was entitled "Glass: Today and Tomorrow." Special demonstrations were given with the newer types of plate and window glass which are employed for safety and for the absorption or transmission of special radiations. Fluorescent lighting and the use of ultra-violet and sodium vapor light were considered as to illumination, sterilization, and tenderizing. The meeting was made particularly interesting by the use of illustrations with colored slides, specimens, and experiments.

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▶▶▶ MORE THAN 2,000 FOREMEN from Michigan and northern Ohio attended a conference held at the University of Michigan which was sponsored by the university's extension service in co-operation with the National Association of Foremen and the Foremen's clubs of Ohio and Michigan to discuss and present a variety of subjects that would be of interest to foremen. Subjects that were discussed included: "The Foreman's Part in National Defense," "What Makes an American Secure?" and various aspects of job training, practical psychology, executive leadership, and methods of handling group grievances.

## REGISTRATION IS HEAVY FOR POLAND SPRING

For the second time, the American Pulp and Paper Mill Superintendents Association will hold its annual meeting at Poland Spring, Maine. Those who attended the 1934 meeting of the Association will recall the delightful surroundings and the genuine hospitality of the Poland Spring Hotel, which is given over entirely to the activities of the Association.

The registration this year has been unusually large, which insures a fine attendance. To date, a final program of papers has not been given out, but those in charge state that a feature of the group meetings will be short papers and plenty of round-table discussion. The membership has been asked for questions to be asked in the various group meetings, and this feature alone is certain to bring out many valuable discussions.

Group meetings will be held on two different days, instead of on the same day as formerly. On Wednesday morning, June 18, the following group meetings will be held: Board, Fine Papers, Newsprint and Wrapping, and Tissue. Meetings scheduled for Thursday morning, June 19, are: Chemical Pulp, Coated Papers, Finishing, Storing and Shipping, Plant & Power Engineers.

If any who expect to attend the convention have not yet made reservations, they should do so at once.

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▶▶▶ THE PAPER CLUB OF NEW YORK is a new organization that was recently formed with the view of establishing social contacts between paper merchants, manufacturers, converters, and representatives of the allied industries. The following temporary officers were placed in charge of the activities of the organization: President, Arthur Pohlman, of the Pohlman Paper Company; vice president, George S. Johnston, Champion Paper & Fiber Company; treasurer, Stanley Styles, of the Martin Cantine Company; and secretary, Alfred S. Walden, Walden, Sons & Mott.

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▶▶▶ VARIOUS GRADES OF PULP have been placed on the National Defense Export Control List. Bleached and unbleached kraft pulp, unbleached sulphite pulp and wood pulp screenings are on the list, but no export license is required at present. A license is required, however for exports of bleached sulphite pulp, containing 80 per cent or more alpha cellulose.

# TAKE A LOOK
# At This Brush Rigging

## It's ONE REASON Why Our New D-c Motors Are So Dependable, and So Economical

THIS improved brush rigging is but one of the many new features of General Electric direct-current motors. Stable operation is assured by the positive contact of the simple, compensating-action holder construction. Steady, economical performance of these motors year in and year out is possible largely because of the rigid, sturdy, and accurate assembly of this vital part.

Our attention to design detail, together with the use of the latest methods and materials—from the inside out—gives you d-c motors qualified better than ever to fill the needs of industry.

Competent engineers in the nearest G-E office will be glad to point out the many advantages you get from the new and improved features of this outstanding motor. Call them, or send for bulletin GEA-1868B. General Electric, Schenectady, N. Y.

**1** Accurately fitted, corrosion-resistant brush-holder studs are held rigidly in position in milled slots by simple and easily accessible flat plate clamps. Studs are insulated from the yoke by a hot-formed, stud-shaped insulating sleeve that is highly arc-resistant—that does not oxidise or carbonise—and is resistant to any deterioration.

**2** Smooth operation and long life of brushes and commutator are possible because a unique, self-compensating, adjustable spring pressure always maintains good brush contact on commutator. If one brush tends to move away from the commutator, additional pressure is exerted on its companion, thus assuring excellent commutation.

*Type CD Heavy-duty Motor, Typical of the Larger Frame Sizes*

GENERAL ELECTRIC

## PULP IMPORTERS ASS'N ASKED TO NAME ARBITRATORS

In order to settle disputes which threaten to tie up national defense production in essential industries, C. V. Whitney, president of the American Arbitration Association, has asked the co-operation of the Association of American Woodpulp Importers to nominate their top-ranking members for service as impartial arbitrators.

"Because an increasing number of business men realize that commercial disputes must be isolated and controlled, there has been a significant increase in the use of arbitration clauses in contracts which provide for the settlement of disagreements by impartial arbitrators," Mr. Whitney said.

"We find from experience that members of trade associations have made our best arbitrators. They have the respect of the parties and the necessary business background to assure a quick and judicious hearing. In fact, it has been almost axiomatic that whenever we send out lists to disputing parties from which they are to choose arbitrators, trade association members are invariably among the top selections.

TOWMOTOR { Speeds up handling / Cuts cost per ton

Here's a typical example of Towmotor speed and economy. Picks up a 1,500 lb. roll, moves it 150 ft. to warehouse, lifts roll 7½ ft., stacks it accurately into place . . . all in *only 65 seconds.* Handles 30 to 40 tons per hour with ease. That's the kind of handling that speeds up production and shipping, saves valuable floor space, keeps "non-productive" costs down low.

CAPACITIES: 1,000 to 10,000 lbs. Any lift to 212 inches. Lifting speeds up to 40 ft. per minute. Speeds: 1 to 9 m.p.h. 2 speeds forward, 2 reverse.

Write for FREE Bulletin. Shows how Towmotor makes tough handling jobs easy and inexpensive.

TOWMOTOR COMPANY 1271 E. 152ND ST. CLEVELAND, OHIO

Let TOWMOTOR (CLEVELAND) take the load off your hands


## A. P. P. A. TO HAVE OFFICE IN WASHINGTON

The fact that all industry is vitally concerned in national defense, and because of the kaleidoscopic changes taking place under present conditions, the Executive Committee of the American Paper and Pulp Association, upon recommendation of the industry's defense committee, decided at a meeting held April 9, to direct the Executive Secretary of the Association to establish a temporary office in Washington for the duration of the present emergency. To join them in supporting such an office the Executive Committee of the A. P. P. A. has asked the co-operation of the National Paperboard Association and the Newsprint Manufacturers Association. All affiliated bodies of the industry may be confronted with problems involving the industry as a result of the National Defense Program, and the Washington office should be of great assistance in solving these problems, and also aid the industry in co-operating with government agencies.

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▶▶▶ A SPECIAL RELEASE from the Association of Pulp Consumers, Inc., is entitled "Allocation of the Supply of Wood Pulp." This release states that "Data compiled and issued by the Forest Products Division of the Bureau of Foreign and Domestic Commerce, based on their own data and that of the United States Pulp Producers Association and the Soda Pulp Manufacturers Association, show that the supply of wood pulp available to the mills purchasing wood pulp is steadily growing less and less, while the amount available to the integrated mills has increased."

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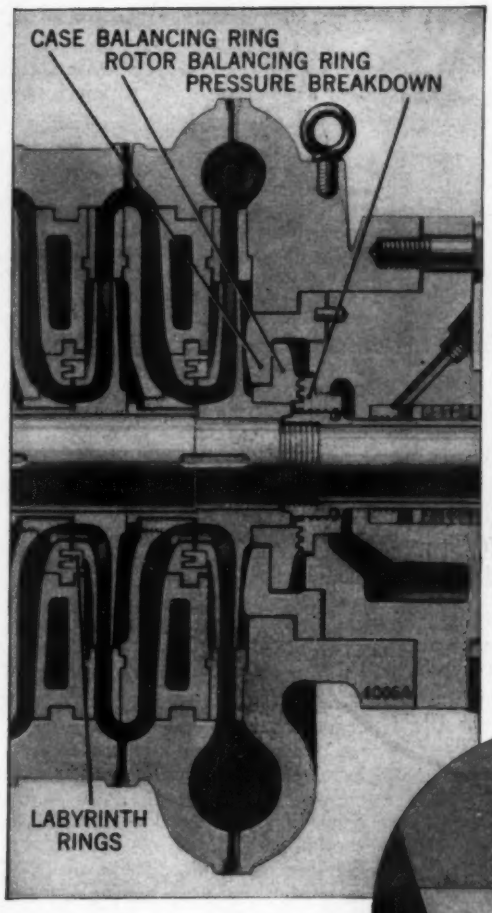
## NW DIV. SUPTS. SPRING MEETING IN MARINETTE

The spring meeting of the Northwest Division of the American Pulp and Paper Mill Superintendents' Association is to be held in Marinette, Wisconsin, from May 23 to 24. Those attending the spring meeting will have the opportunity to visit mills in Marinette and Peshtigo where many different kinds of paper are manufactured.

It was announced that every effort is being exerted by the committee in charge to make the meeting unusually interesting and profitable for all who attend. Reservations should be sent to John V. Ziemann of the Southern Kraft Corporation, Marinette, Wis.



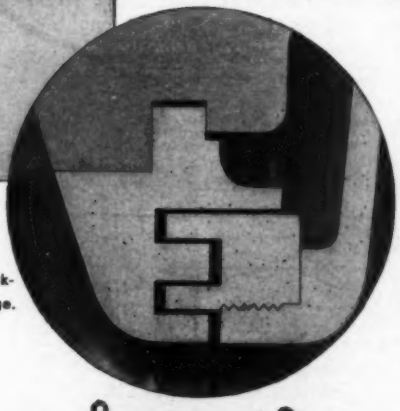

# *How* HIGH EFFICIENCY *is sustained in* DE LAVAL MULTI-STAGE PUMPS

THE De Laval labyrinth wearing rings reduce leakage to one-third of that which occurs with flat rings having the same clearance. Because of the reduced leakage velocity, labyrinth rings have longer life.

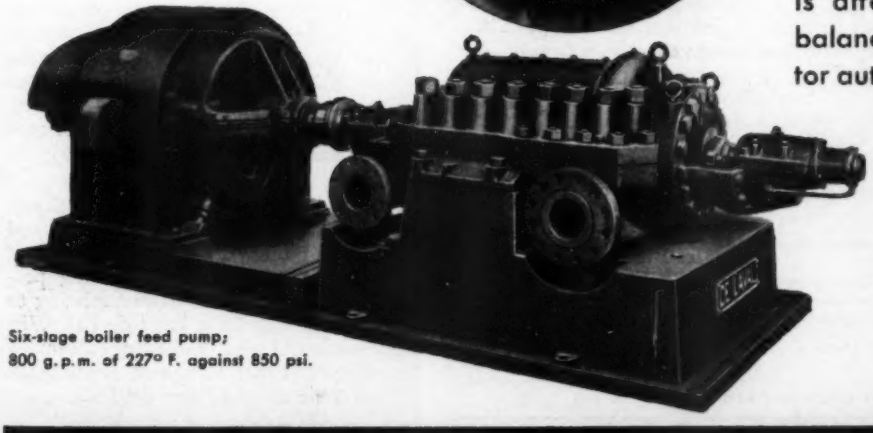
The De Laval multistage pump does not depend upon a thrust bearing to maintain axial position of rotor, but remains in perfect hydraulic balance under all operating conditions. Neither balance nor leak-off is affected by wear of the balancing disks, since the rotor automatically maintains the correct clearance.

All parts in a De Laval pump that are subject to wear are interchangeable and renewable.

*Ask for Catalog P-3218*



Labyrinth wearing rings, which minimize leakage from d scharge to suction in each stage.



Six-stage boiler feed pump; 800 g.p.m. of 227° F. against 850 psi.

DE LAVAL *Steam Turbine Co.*
TRENTON, N. J.

MANUFACTURERS OF TURBINES ... STEAM HYDRAULIC PUMPS ... CENTRIFUGAL PROPELLER ROTARY DISPLACEMENT, MOTOR-MOUNTED, MIXED FLOW, CLOGLESS, SELF-PRIMING CENTRIFUGAL BLOWERS and COMPRESSORS GEARS ... WORM, HELICAL and FLEXIBLE COUPLINGS

# S A F E T Y

## I.A.P.A. REVIEWS SAFETY WORK OF ASS'N IN 1940

The general manager of the I.A.P.A., R. B. Morley, in speaking before the annual convention of the Industrial Accident Prevention Association held in Toronto recently, stated that while educational posters and cartoons would not be a cure for all accidents, but those firms that used accident-prevention literature as a form of advertising against accidents got the best safety results.

In reviewing the activities of the association, it was announced that they had sent out more than a million pieces of literature, more than half of which were posters, to some 9,000 industrial plants in Ontario. It was also announced that the association had organized an inspection staff of 16, who had made 11,000 visits to plants during 1940.

▶▶▶ DAMAGE TO THE EXTENT of $50,000 was caused by a fire that burned a storage shed of the Canadian International Paper Company's Gatineau Mill, Quebec, recently. The cause of the fire has not been determined. One million feet of fiber board and a quantity of machine parts were damaged by the blaze. The efforts of the company's fire department prevented the fire from spreading to the other buildings nearby but were unable to save the storage shed which was left in ruins in less than an hour after the fire started.

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▶▶▶ TWENTY NEW HIGH FREQUENCY two-way radio sets recently have been purchased to aid in protecting the Nicolet national forest in Wisconsin from forest fires. Use of the new radios will enable fire tower observers to dispatch tank trucks and fire crews to fire scenes immediately, and also will provide instant communication with CCC units that are working near by, calling them to help fight the fire. The new sets are said to function without static, even during severe electrical storms or other atmospheric disturbances.

◆

## QUEBEC ASS'N REVIEWS COST OF ACCIDENTS

Accidents have cost $25,000,000 in Quebec's pulp and paper industry over the last nine years, it was reported by W. L. Bennett, president of the Quebec Pulp and Paper Safety Association, at the association's ninth annual meeting held in Montreal last month. It was also pointed out by Mr. Bennett, who was re-elected as head of the group, that workmen should be educated to realize the menace of accidents, while the company executives should emphasize accident prevention measures.

In a comparison between the years 1939 and 1940, it was found that 58 per cent more accidents had occurred than in 1939, while in the logging operations the increase reported was 51 per cent. Also fatal accidents in mills increased from four to five; and, in the bush, from 13 in 1939, to 25 last year. Claims accepted by the Quebec Workingmen's Compensation Commission for mill accidents totaled 1,508 for medical aid only, and 631 involving compensation, while bush accidents totaled 1,035 for medical aid, and only 6,800 involved compensation.

◆

▶▶▶ THE YEAR OF 1940 showed the most favorable results in fire prevention in the history of New Brunswick from the standpoint of acreage burned over and damage done. A total of 220 fires were reported, compared with 256 the previous year, while the acreage burned over was 10,000 less and the damage was only 13 per cent of that in 1939.

◆

▶▶▶ ALL OF THE SESSIONS participating in the Fox River Valley and Lake Shore Safety Conference have prepared particularly interesting programs for the 14th annual meeting to be held May 22 at Fond du Lac, Wisconsin. L. C. Smith, of Thilmany Pulp & Paper Company, is chairman of the Pulp and Paper Section.

◆

▶▶▶ WITH VACATION DAYS just ahead, everyone should exercise caution to prevent the spread of fires in the woods. The slightest carelessness may start a conflagration such as the disastrous forest fire that swept through the East recently.

## The Paper Industry Safety Contest

**July 1, 1940 to June 30, 1941**

**Out of 183 mills reporting for March, 15 have perfect record**

**PERFECT SCORES**
**Division I—Pulp and Paper Mills**

| PARTICIPANT | MILL | LOCATION |
|---|---|---|
| **GROUP A** | | |
| **GROUP B** | | |
| P. H. Glatfelter Co. | Spring Grove | Pennsylvania |
| **GROUP C** | | |
| Price Brothers & Co., Ltd. | Jonquiere, P.Q. | Canada |
| **GROUP D** | | |
| The Mead Corporation | The Harriman Co. | Harriman, Tenn. |
| Bird and Son, Inc. | Phillipsdale | Rhode Island |
| American Writing Paper Corp. | Parsons Division | Holyoke, Mass. |
| American Asphalt Roof Corp. | East St. Louis | Illinois |
| United States Gypsum Co. | North Kansas City | Missouri |
| The Mead Corporation | Nashville | Tennessee |
| *Spaulding Fibre Co., Inc. | Milton | New Hampshire |
| Central Fibre Products Co. | Vincennes | Indiana |
| Alton Box Board Company | Carlyle | Illinois |
| *Spaulding Fibre Co., Inc. | Hayes | New Hampshire |

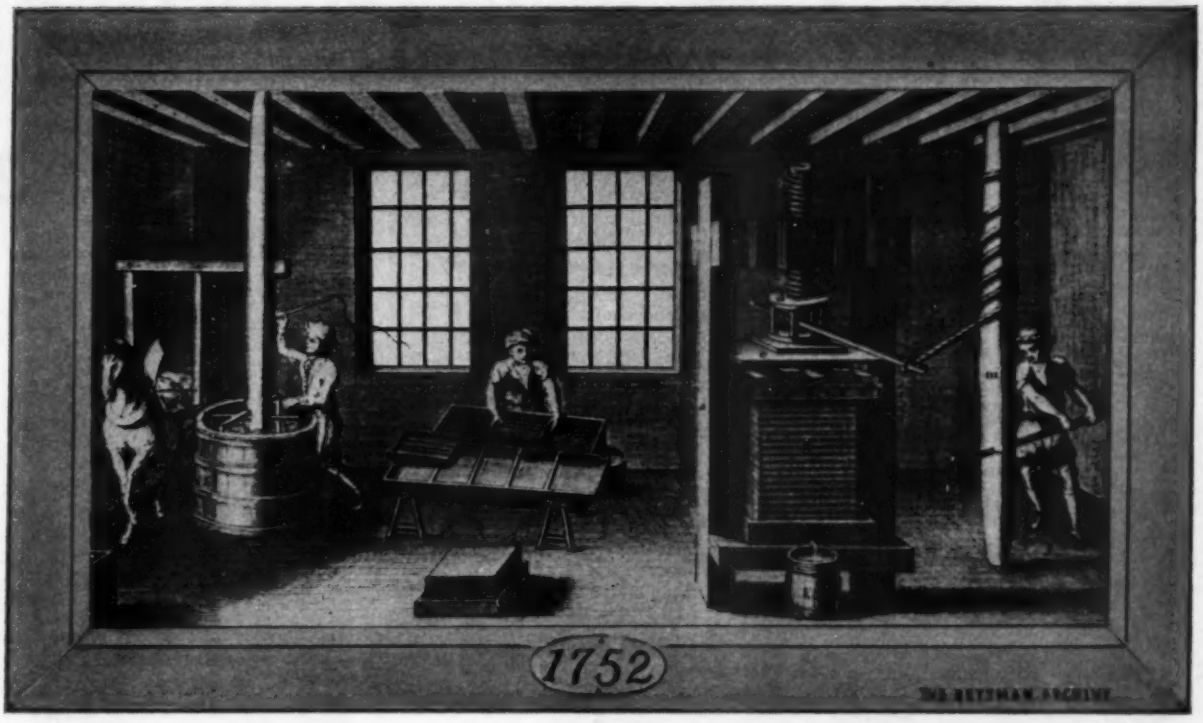
**Division II—Paper and Board Re-Manufacturing**

| | | |
|---|---|---|
| Bird and Son, Inc. | Chicago | Illinois |
| Bird and Son, Inc. | Shreveport | Louisiana |
| Bay West Paper Co. | Green Bay | Wisconsin |

*March report missing—covers eight months only.

**SUMMARY OF CONTEST EXPERIENCE**

| Division | Man-Hours Worked | Reportable Injuries | Frequency Rate 1940-41 (9 mos.) | Comparison of Rates with 9 mos. of 1940 |
|---|---|---|---|---|
| All Divisions | 133,633,560 | 1,846 | 13.81 | —6% |
| Paper & Pulp | 120,624,848 | 1,691 | 14.02 | —7% |
| Group A | 79,429,186 | 950 | 11.96 | —5% |
| Group B | 21,921,812 | 351 | 16.01 | —8% |
| Group C | 12,941,578 | 256 | 19.78 | —6% |
| Group D | 6,331,972 | 134 | 21.16 | —9% |
| Paper & Board Re-Manufacturing | 13,008,712 | 155 | 11.92 | —2% |




# *Before*

## INVENTIVE GENIUS WAS APPLIED TO THE MAKING OF PAPER

Every sheet was made by hand—in 1752. Power then was really "horse power." Machines existed only in the minds of dreamers—and ton production was not even dreamed of. From this hand process grew the 1941 modern production paper mill, after inventive genius was applied to making paper. Machines were developed, and an art became an industry. Felt layers were used to remove water from the paper, but these too gave way to production felts, and since then progress in felt making has kept pace with progress in paper making. Since 1890 Appleton Felts have each year met all requirements of paper mill production, and today are standard for those characteristics paper mills require in felts to make good paper.

This is one of six advertisements illustrating the early history of paper making.

make APPLETON FELTS good paper

# *Appleton Woolen Mills*

APPLETON • WISCONSIN

# NAMES *in the* NEWS

## *Personals*

### CHARLES ELLIS NEW PRESIDENT OF DOWNINGTOWN

"Charlie" Ellis, well-known as vice president of Downingtown Manufacturing Company, Downingtown, Pennsylvania, was elected president of the company at a recent meeting of the board of directors. Mr. Ellis started his career in the paper industry with Charles Carr of Boston, who was Consulting Engineer for a number of paper mills.

Charles Ellis

The next position that he held was with the F. W. Bird & Sons, East Walpole, Massachusetts, where he had charge of the Box Shop Division Drafting Room. Later the company transferred him to the Paper Mill Division Drawing Room and following this he was made master mechanic, a position which he held for several years. When the Bird Company bought the Roofing Felt Mill at Pont Rouge, Quebec, he was sent there as superintendent.

After leaving Bird Company, he became associated with Downingtown Manufacturing Company as sales engineer, and after working in this capacity for three years he became a director of the company in 1914. In 1920, he was elected second vice president and sales manager, and in 1932 he became vice president.

He has been a member of the American Pulp and Paper Mill Superintendents Association and was an organizer of the Pennsylvania-New Jersey Division, having acted as chairman of this division several times. Mr. Ellis also has to his credit several patents. Among the most important are the Extractor Roll and the Downingtown Wire Faced Suction Extractor Roll.

The members of the board of directors are: Mr. Ellis, Ellis Y. Brown, Jacob Edge, Enright A. Ellis, Edward T. Street, and W. Perry Tyson.

◆

▶▶▶ An honorary life membership in the Technical Section of the Canadian Pulp and Paper Association was recently awarded *T. L. Crossley,* Toronto, in recognition of his long and devoted service to the work of this Section, of which he was one of the founders. Mr. Crossley was recently appointed Director of Training at important units of munitions production.

◆

### BUCHANAN NAMED WHITAKER'S NEW CHICAGO MANAGER

The Whitaker Paper Company, with head offices in Cincinnati, Ohio, has appointed C. Lawrence Buchanan manager of its Chicago office to succeed the late John T. Hillyer (See Necrology).

Mr. Buchanan is well fitted for his new position, having been connected with the company's Chicago office for nearly twenty years. Prior to that, he was with the Cincinnati office.

◆

▶▶▶ *Malcolm S. Black,* the former personnel manager of the Union Bag & Paper Corporation, New York City, was recently elected secretary and treasurer and a member of the corporation's Board of Directors. Mr. Black joined the company last year as personnel manager. He was previously associated with the Bliss, Fabyan & Company, New York City.

◆

▶▶▶ *R. W. Mayhew,* president of the Sidney Roofing and Paper Company of Victoria and Vancouver, British Columbia, has been appointed one of the two British Columbia representatives on the National Committee on Wartime Production. He was nominated by the Canadian Manufacturers' Association, of which he is chairman of the British Columbia division.

### HOFFMAN IS NEW VICE PRESIDENT OF LINK-BELT

At a recent meeting of the board of directors, Ralph M. Hoffman was elected vice president of the Link-Belt Company, Chicago, and was delegated as general director and supervisor of sales for this company.

Mr. Hoffman is a graduate of the University of Minnesota in Mechanical Engineering. He joined the Link-Belt organization in 1923 in the capacity of manager of the Meese & Gottfried Company's Seattle branch and in 1931 he was promoted to the position of vice president and sales

Ralph M. Hoffman

manager of this subsidiary. In 1940 he was promoted to assistant to the president with his headquarters in Chicago in which position he served until the recent election.

◆

### CHARLTON NOW WITH UNION BAG & PAPER

When the April issue of this magazine was ready to go to press, an announcement was received that E. A. Charlton had resigned his position as manager of Crossett Paper Mills, Crossett, Arkansas (Cf. *P. I. & P. W.* page 54, April, 1941). The first announcement carried no statement concerning Mr. Charlton's plans for the future, but just before the issue was mailed a further announcement was received which stated that Mr. Charlton has accepted a connection with the Union Bag & Paper Corporation. He will

IT'S A VERY HIGH GRADE PAPER
so there must be no danger that it will be specked by corrosion of the metal parts used in agitating the pulp.

## THAT'S WHERE *DURCO* KA2SMo MEETS ALL SPECIFICATIONS

When Shartle Bros. Machine Company was called upon to provide an unusual battery of circulating agitators in which all danger of contamination of the paper stock must be eliminated they consulted us about special castings for the installation.

Housings for the impeller and the shaft were cast of Durco Stainless Steels, to their designs. This austenitic alloy is proof against corrosion from chlorine left in the bleached pulp. Its low carbon content and the advanced methods of heat treatment employed with the finished castings are assurance against intergranular attack that might eventually destroy the strength and ductility.

Durco Stainless Steels and equipment are helping to build a greater Pulp and Paper Industry. If you want to rid yourself of the problems of corrosion, specify Durco Stainless Steels for your equipment.

DURIRON · DURICHLOR
CORROSION-RESISTING
DURCO
ALLOYS & EQUIPMENT
THE DURIRON CO. INC. DAYTON OHIO
DURIMET · DURCO STAINLESS STEELS

**THE DURIRON COMPANY, INC.**

**NORTH FINDLAY STREET** **DAYTON, OHIO**

make his headquarters in the company's New York offices and will act in the capacity of consulting engineer.

Mr. Charlton is a graduate of McGill University with a degree in engineering. Since graduation, he has worked as an engineer and an executive in the paper industry. He has been associaetd with such well-known companies as International Paper Company, Abitibi Power & Paper Company, Brompton Pulp & Paper Company, U. S. Lumber Company, and the Crossett Paper Mills.

◆

## LINCOLN ELEC. SENDS BRUGGE TO WASHINGTON

B. J. Brugge, welding consultant for the Lincoln Electric Company, Cleveland, Ohio, was recently appointed welding consultant and engineer at Washington, D. C. His new position will involve consulting work dealing with the application of arc welding in the National Defense Program and he will be available for such work with all governmental departments. His new offices will be located in Baltimore, Maryland.

Mr. Brugge is well-known for the job that he accomplished in the field of electrical welding in the Near East. He was employed in the capacity of welding superintendent for the Anglo-Iranian Oil Company for two years, which time he spent supervising welding operations in construction of refineries and pipe lines. Also during this period he directed the training of many Persians in the art of welding and increased the company's welding force from 30 to 120 arc welders.

Since 1931, following four months experience in the British Isles as welding consulting engineer for British and Scottish firms, he has been associated with the Lincoln Company in Houston, Texas.

◆

## ROBT. L. CLAUSE IS PRESIDENT OF PITTS. P. GLASS

At a recent meeting, Robert L. Clause of the Pittsburgh Plate Glass Company, Pittsburgh, Pennsylvania, was elected president of the company. He is succeeding H. S. Wherrett who is being promoted to the position of vice chairman of the board of directors, a new office created by the stockholders at the annual meeting.

Mr. Clause is a graduate of Cornell University in Mechanical Engineering and was employed by the Pittsburgh Plate Glass Company in 1895 immediately following his graduation. He was first employed as a draftsman and

Robt. L. Clause

served successively as an assistant superintendent and general superintendent of plate glass manufacturing.

In 1922 he was elected a director of the company and in 1926 he became vice president. For the past 14 years he has been head of the company's glass division.

◆

## BELLOWS & CRANE IN NEW POSTS AT BYRON WESTON

At a recent meeting of the stockholders and directors of the Byron Weston Company, Dalton, Massachusetts, John H. Bellows was elected to the office of vice president and treasurer in charge of the company, and Robert Crane, who was appointed secretary of the company as well as manager of sales in 1940, was appointed

J. H. Bellows

a member of the board of directors.

In 1902, Mr. Bellows became associated with this company, when he entered the manufacturing department of the mill. During his 39 years of continuous service he has served in many important positions in the organization. Successively he was employed as production manager, director, assistant treasurer, and treasurer and clerk of the corporation.

Mr. Crane, who has served as the eastern sales manager in charge of the New York office and was appointed manager of sales in 1940, will continue to carry out the duties of the latter appointment together with the responsibilities incurred by his recent appointment as a director of the company.

◆

## FRANKLIN McELWAIN MARKS 60 YEARS AS A PAPERMAKER

A man of high standing in the paper industry, R. Franklin McElwain of the Crocker-McElwain Manufacturing Company, Holyoke, Massachusetts, recently celebrated his 60th anniversary as a papermaker. He retired at the age of 63, and 11 years later, at 74, he returned to work, explaining his decision by saying that "the smell of paper mill bleach was too strong to be ignored."

In 1903, Mr. McElwain and Mr. Crocker started the Crocker-McElwain Company, and in 1913 bought the Chemical Paper Company. (In 1928 he retired from the business and returned as president and general manager in 1939.)

◆

▶▶▶ The Quebec North Shore Paper Company's mill at Baie Comeau recently appointed *Romeo Comette* as the general superintendent of the company. He will succeed Russell Cooper, who has accepted a similar position with the Powell River Company, Powell River, British Columbia.

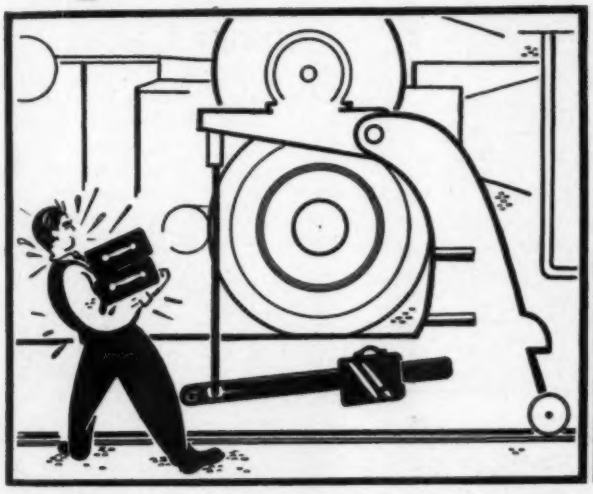
◆

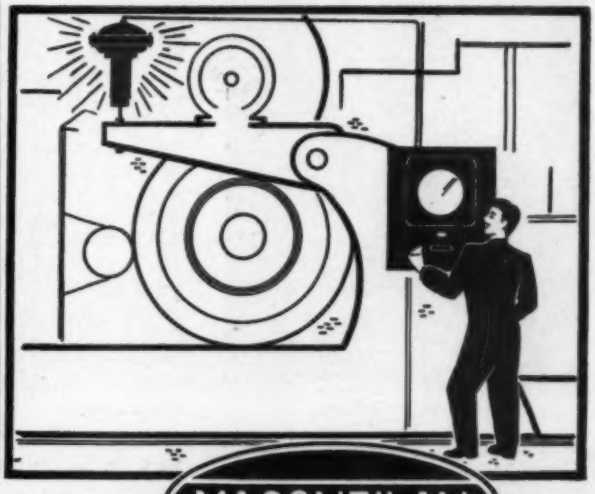
## CLYDE B. MORGAN LEAVES RAYONIER TO HEAD EASTERN

After four and one-half years with Rayonier, Inc., Clyde B. Morgan has resigned as vice president and leaves New York to become president of Eastern Corporation, Bangor, Maine.

Mr. Morgan was resident manager of the company's plant at Fernandina, Florida, during its construction. Prior to his association with Rayonier, Mr. Morgan served as executive vice president of S. D. Warren Company, Boston.

# A Load on Your Mind... or EXACT-A-LOAD CONTROL?





Take a load off your mind and off your operating income by installing this modern roll load control which not only simplifies the operators work but saves time, paper and equipment. By applying exactly the load you want on each end of the roll and *maintaining* it in spite of lumps in sheet or rolls out of round, Exact-a-Load Control insures a more uniform sheet; by unloading both ends of the roll simultaneously Exact-a-Load Control saves the felt when sheet breaks occur.

Exact-a-Load is made in indicating or recording types, for either "load and unload" or "load and lift." Write for complete data.

MASONEILAN

**MASON-NEILAN REGULATOR CO.**

**1196 ADAMS STREET**
**BOSTON, MASSACHUSETTS**

Atlanta Buffalo Chicago Houston
Los Angeles New York Philadelphia
Pittsburgh San Francisco St. Louis
Toledo Tulsa
Mason Regulator Co. of Canada, Ltd.,
Montreal

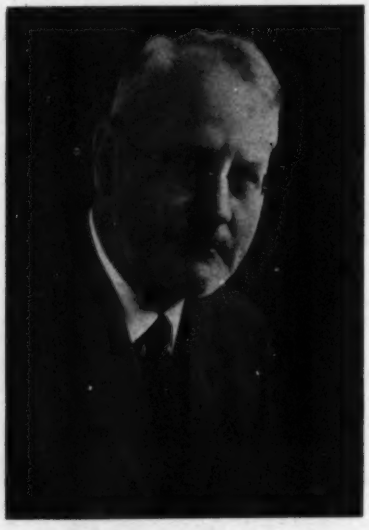
▶▶▶ A leave of absence has been granted to *William Howes Collins,* the assistant industrial advertising manager of the Scott Paper Company in Chester, Pennsylvania, so that he can fill the position of Lieutenant (Junior Grade) of the Fourth Naval District in the United States Naval Reserve.

◆

▶▶▶ Announcement has just been made of the appointment of *Hubert H. Henderson* as treasurer and credit manager, and *Henry C. Noseworthy* as secretary of Fraser Companies Ltd., and subsidiary companies. Mr. Henderson, who has been associated with the company since 1919, has been assistant treasurer and credit manager of the company and its subsidiaries since 1930. Mr. Noseworthy joined the company in 1933, and later in that year was appointed assistant secretary, which position he has held until the present promotion.

# Necrology

▶▶▶ *George H. Danner,* one of the original founders of the Pittsburgh Piping and Equipment Company, Pittsburgh, Pennsylvania, and also president and general manager of this



George H. Danner

company, passed away April 11 at the age of 66. Mr. Danner has been associated with the company for 40 years and has served as president since the founding.

◆

## CHARLES B. NOLTE

Charles B. Nolte, president of the Crane Company, Chicago, passed away April 29 at the age of 55. He had been working in this capacity since 1935. Mr. Nolte was a member of the American Society of Mechanical Engineers, the American Society of Civil Engineers, and many other national and local organizations.

Before his affiliation with the Crane Company, he was employed as president of the Robert W. Hunt Company, Chicago, for six years. Immediately following his graduation from the University of Illinois, he started working for the Hunt Company, where in 1929 he was made president of the organization. Other capacities in which he served while with Crane were as a director and also president and director of the subsidiaries. Mr. Nolte is survived by his widow and two children.

◆

## JOHN T. HILLYER

John Thomas Hillyer, vice president and Chicago manager of the Whitaker Paper Company, whose head offices are located in Cincinnati, passed away suddenly on April 12. Mr. Hillyer was 57 years of age and had been associated with the Whitaker Company for eighteen and one-half years.

He started his career in the paper industry at the age of 17 when he joined the Melady Paper Company in St. Paul. Other organizations that he was affiliated with are the Wright, Barrett & Stilwell Paper Company in St. Paul and the Paper Supply Company of Minneapolis. The Monday meeting of the Salesmen's Association in Chicago, was cut short so that the members could attend the services in a group. Mr. Hillyer is survived by his widow.

◆

▶▶▶ *Byron Brown Taggart,* well-known, paper manufacturer in the Watertown area of New York, recently passed away at the age of 67. Mr. Taggart expanded the manufacturing firm of Taggart Brothers, which was founded by his father, until it controlled plants in Oswego and Herrings, New York, as well as in Watertown. He was also president of the Taggart Corporation which he organized. His widow and four children survive.

◆

## HENRY W. ELLERSON

Henry Watkins Ellerson, president of the Albemarle Paper Manufacturing Company, Richmond, Virginia, passed away May 6 at his home near Richmond, after a brief illness. He was 65 years of age.

Widely known in the paper industry, Mr. Ellerson was a former president of the Southern Kraft Association, and in 1939 he became president of the National Paperboard Association. During the NRA days, he served as a member of the paper industry authority.

Born in Richmond, Mr. Ellerson was educated in private schools and began his business career at an early age. In 1925, he was active in organizing the Chesapeake Corporation, of West Point, Virginia, becoming vice president of that corporation and the Chesapeake Camp Corporation, Franklin, Virginia.

Surviving are his widow, three daughters, and a son.

◆

▶▶▶ *Brenton Crane Pomeroy,* president of the Byron Weston Paper Company, Dalton, Massachusetts, passed away recently at the age of 48. He served as sales manager in 1934 and later served as vice president and treasurer under the late Donald Weston. His next step was to the presidency, in which position he remained until recently. He is survived by his widow.

◆

## ALMON A. BUSH

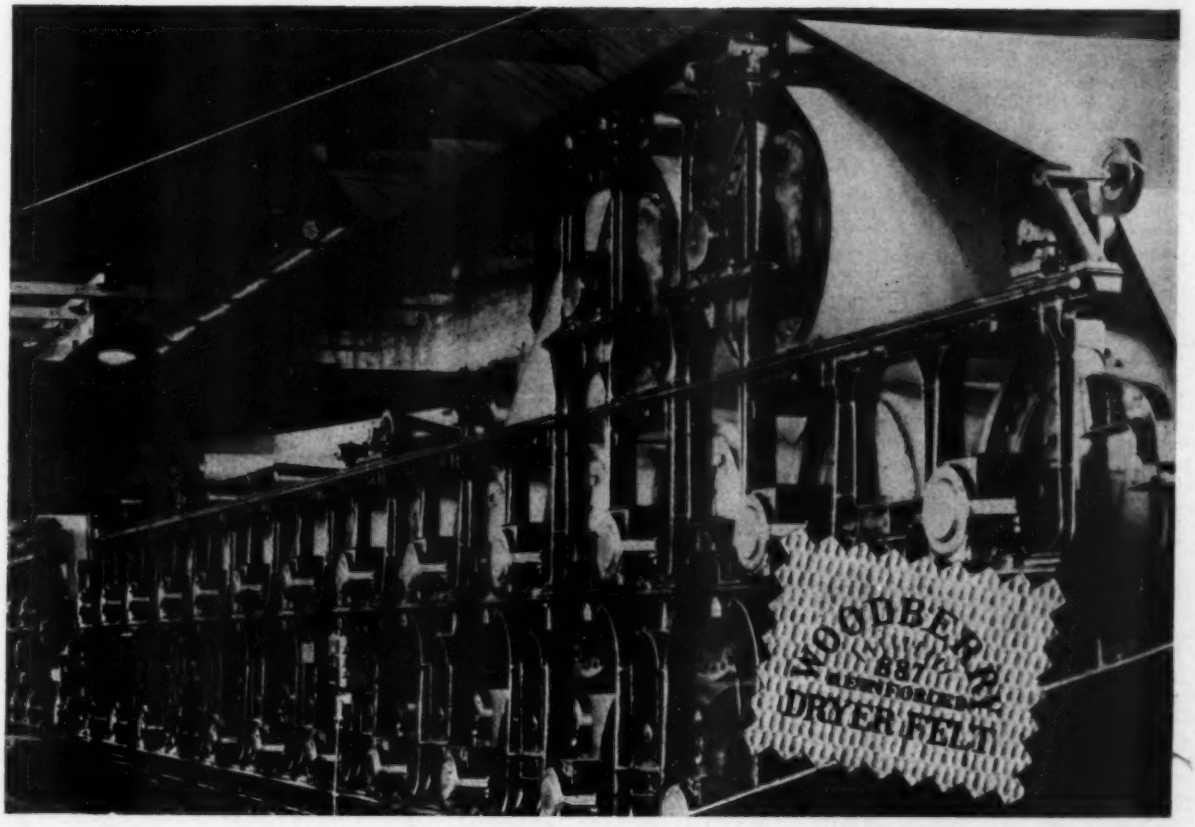
The vice president of the E. D. Jones & Sons Company, Almon A. Bush, recently passed away at the age of 77. He had been associated with this organization for 39 years. In 1928, Mr. Bush was elected a director, vice president, and manager in which capacities he served until 1935, when

A. A. Bush

he retired, but retained the office of vice president. He was a member of the Technical Association of the Pulp and Paper Industry and during the period of NRA worked on committees relative to codes for the Paper Mill Machinery Trade.

Surviving are his widow, a son, and a daughter.

# Are **You** One of Those Who Has Reduced Dryer Felt Costs With **WOODBERRY 887's?**




For more than two years WOODBERRY 887's have been effecting important dryer felt economies for leading paper mills throughout the country. A patented construction with a face reinforced by asbestos yarns greatly prolongs their life and reduces dryer felt costs per ton of paper made.

Shrinkage and stretch in these precision built dryer felts is low. They require fewer adjustments and account for fewer production delays. Their rate of transpiration is high and they are often responsible for lowered steam consumption. Specify WOODBERRY 887 dryer felts for all round dryer felt efficiency and economy.

MT. VERNON WOODBERRY MILLS, INC.

**TURNER HALSEY COMPANY**

*Selling Agents*

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CHICAGO · NEW ORLEANS · SAN FRANCISCO · BOSTON · BALTIMORE · LOS ANGELES

# Convention Papers . . . Abridged

## Measuring and Recording Freeness Continuously

ARTHUR B. GREEN, Engineer

Freeness is a measurement of drainage rate. Drainage rate varies: freeness, stock density, and stock temperature. If the mill already controls density and temperature with precision, then it is only necessary to add means of measuring freeness and the measurements can be accepted as freeness purely. If the mill does not control density and temperature with precision, that control ought to be established, quite aside from the single matter of indicating and recording stock freeness.

If a mill depends on batch beating for any considerable portion of the stock preparation, the place for stock density control is in the batch beaters. Only by that control can the furnishes be exact and such matters as fiber count, sizing, coloring, and loading come within precision limits. A mill which controls stock density in the batch beaters has little trouble carrying that control forward and has no need for what is called a consistency regulator following the beaters. A mill which does not control stock density in the batch beaters, and instead of getting that control installs a consistency regulator further on, is trying to smooth out an unnecessary error after it has been committed and still is leaving out of account a number of related errors that make consistency regulators inaccurate and make machine operation uncertain and the final product nonuniform. When batch beating is out of control as to stock density, it is bound to be out of control as to stock treatment also, and a stock coming to a consistency regulator varying in such factors as fiber length, furnish, freeness, and hydration will prevent any consistency regulator from doing its work.

There are mills where batch beating accounts for a negligible amount of stock preparation, and other mills where there is no batch beating. Here, if stock is to be regulated by its density, it must be regulated in a slush line.

Common to all the commercial consistency regulators is some way of registering the stock fluidity, since this, assuming uniform average fiber length, freeness, and hydration, runs inversely as the stock density. From that point on, the commercial units divide into two groups: one group positioning a diluent water valve in proportion with stock fluidity, the other moving a diluent water valve at some set rate in one direction or the other as the stock fluidity may determine. Neither the proportional valve positioning nor the set rate of valve movement suffices to make the corrections dependably.

If stock fluidity goes rapidly down, quickly reaching a point far below the norm, the diluent water valve must move toward open fast, and keep moving until it succeeds in turning the stock fluidity back upward toward norm. If, however, stock fluidity moves off norm but a little, the valve must likewise move less and move more slowly.

Some technicians believe that automatically recording stock densities is comparatively novel. Actually we have been recording stock densities automatically since 1914.

Recording freeness continuously serves one of the purposes of management, which is to have all men concerned know what is happening to the materials of manufacture while going through the processes of manufacture. In the case of papermaking materials, freeness is an important fact to know. Burst, fold, tear, tensile, stretch, shrinkage, pliability, and bulk are among the other factors. Duplication of freeness does not bring duplication in any of the other factors by itself, so freeness cannot be read alone as the one control variable in papermaking; but so closely is freeness related with possible machine speeds, drying capacities, and formations that no papermaking is under control where freeness is not controlled.

If freeness, with its fluctuations, is continuously in plain sight of the operator, and comes after the continuous stock-treating units (such as jordans) which the operator is running, then the operator may receive precise freeness specifications for every order to be made. If the continuous freeness indications are automatically charted, then the operator can submit a daily report showing the freeness of the product during manufacture. If the recorded freenesses are accumulated, they provide definite information of use when running down difficulties and imperfections in the mill and when investigating customer complaints, besides offering the basis for progressive refinements in manufacture through better and better freeness specifications. When the occasion arises for making a new grade, or using a new stock to make an old grade, the accumulated records point with great accuracy to the new specifications that should be drawn, and protect the mill from a good deal of unnecessary guesswork.

Finally, it will be possible, though it has not yet been actually done, to couple freeness measurements to the adjusting mechanism of the jordans or other continuous machines so as to operate them mechanically in response to stock freenesses, so as to maintain the delivered freenesses within any desired tolerance of a predetermined specification.

The machine tender, when he can talk freenesses with his jordan operator in a common language of impartial units of measurement, gains in confidence as he witnesses his jordan operator's ability to run to a freeness line, and steps up his speed and production as soon as he feels that there will not be any more freeness fluctuations to guard against.

**This is the third installment of abridgments, prepared by our editorial staff, of papers presented at the annual meeting of the Technical Association of the Pulp and Paper Industry, held in New York City, February 17-20, 1941. The first two installments appeared in the March and April issues. The remaining abridgments will be published from month to month until completed.**

## Volume, Sales and Costs Relationship

BENTON R. CANCELL, Economist
American Paper and Pulp Association

It is the intention of this paper to present a simple graphic method of analyzing for management the various profit relationships which occur when volume is varied within the different ranges of operation and prices are decreased to gain additional volume. The terms "fixed costs," "variable costs," "normal operation," and "break-even point," are used consistently and are defined as follows:

Fixed Costs—those costs which are fixed in aggregate and vary with the units of output.

Table I

| Increase (per cent) | Decrease in overhead costs per ton |
|---|---|
| From 30 to 40 | $27.78 |
| From 40 to 50 | 16.66 |
| From 50 to 60 | 11.11 |
| From 60 to 70 | 7.94 |
| From 70 to 80 | 5.95 |
| From 80 to 90 | 4.63 |
| From 90 to 100 | 3.71 |
| From 100 to 110 | 3.03 |
| From 110 to 120 | 2.51 |

Variable Costs—those costs which are fixed per unit but the aggregate varies with volume of output.

Normal Operation—that percentage of operation which the company has established as full capacity for a definite budgetary figure. Actual capacity may go well beyond normal.

Break-Even Point—that point at which the total cost involved in production and sales are exactly covered by the net revenue from sales.

In a paper mill in which $50,000 per month of overhead costs have been allocated to a paper machine which is capable of producing 1,500 tons of one grade of paper, at normal operation, it is significant that in the lower ratios of operation, small increases in the production ratio result in substantial decreases in the overhead costs per ton. Thus an increase from 30 to 40 per cent in production results in overhead cost decrease per ton as shown in Table I.

# NO PRODUCTION TIE-UPS

*when you use*

# MONEL-COVERED ROLLS

## *Pioneered by Pusey & Jones in high speed fourdriniers, this tough, corrosion-resistant cover has proved its worth*

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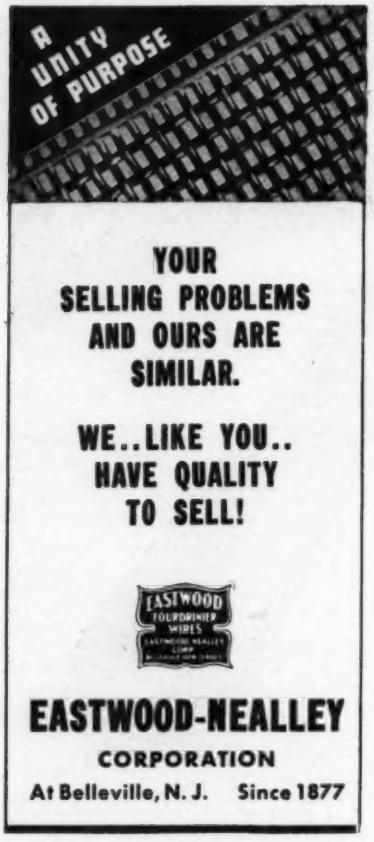
**THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall St., New York, N. Y.**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The relative importance of the overhead costs as a determinant of company policy depends upon the value of the paper manufactured. As the grade and value of the product increases and the variable costs grow proportionately, the decrease in fixed costs become less important as a pricing factor with increases in volume of production.

If, on a basis of ratio of production, the total monthly cost of operating the paper machine is plotted against the total monthly sales of the product of the machine at any single price, a graphic analysis is obtained which shows directly the point in operation at which sales will cover all costs. Thus, the costs, as shown in Table 2, are plotted for the monthly sales of the product at $125.00 per ton.

Assuming that the company in question must drop its price level $5.00 per ton for each 10 per cent of additional volume sought, Table 3 shows the total sales per month, profit per ton, and total profit per ton at the various levels of operation.

It will be seen that under these conditions the highest profit per ton is reached at 80 per cent of normal operation and at a sales price of $115.00 per ton, while the highest aggregate profit occurs at 90 per cent of capacity and a sales price of $110.00 per ton. Up to the 90 per cent level, $5.00 per ton decreases to obtain 10 per cent additional volume for each decrease would tend to maximize the total profits. Beyond 90 per cent, however, additional volume although increasing the total dollar sales, would only serve to further narrow profit margins per ton and would decrease total profits substantially.

The company would break even at the ratios of operation and at the price levels shown in Table 5.

Thus the volume necessary to compensate for equal price declines in the higher brackets of operation rise to formidable limits. Since the high volume ratios are difficult to maintain over long periods of time, it seems poor managerial policy to attempt under normal conditions to attain sustained high volume at the cost of major price concessions.

Accurate charting of such data provides readily the percentage profit on costs which operations will yield at any selling price and ratio of production. For instance, at 7 per cent of normal, a price of $130 per ton would yield 13.7 per cent $125 per ton would yield 9.4 per cent; $120 would yield 5 per cent; $115 would yield 0.6 per cent, and $110 would result in a loss of 3.7 per cent.

**Table 5**

| Sales Price per Ton | Break-Even Point Per Cent | Additional Volume Necessary to Compensate for Price Decreases Per Cent |
|---|---|---|
| $130 | 53 | ---- |
| 125 | 57 | 4 |
| 120 | 62 | 5 |
| 115 | 69 | 7 |
| 110 | 77 | 8 |
| 105 | 87 | 10 |
| 100 | 100 | 13 |

This type of analysis is adaptable to company operations as a whole as well as to individual machines and single products. Its major difficulty lies, however, in the comprehensive breakdown of costs necessary to analysis. For any company operating on a flexible budget, the mechanical procedure is simple, but where inadequate accounting practices are in effect, a major "operation" is necessary to revise the system of costs accounts.

## Floc Forming Chemicals and Their Application to Paper Manufacture

**LEWIS B. MILLER, Chemical Engineer**
**Keasbey & Mattison Company**

At the present time floc forming chemicals are made use of in the pulp and paper manufacturing processes for the following: (1) To condition the process water so that rosin size or other sizes will tend to separate from it and to adhere to the

**Table 2**

| Level of Production (% of normal) | Tons Produced per Month | Total Fixed Cost per Month | Fixed Cost per Month | Total Variable Cost per Month | Variable Cost per Ton | Cost per Ton | Total Cost per Month |
|---|---|---|---|---|---|---|---|
| 0 | 0 | $50,000 | $ ..... | $ ..... | $ .... | $ ..... | $ ..... |
| 25 | 375 | 50,000 | 133.33 | 25,000 | 66.67 | 200.00 | 75,000 |
| 50 | 750 | 50,000 | 66.67 | 50,000 | 66.67 | 133.33 | 100,000 |
| 60 | 900 | 50,000 | 55.56 | 60,000 | 66.67 | 122.22 | 110,000 |
| 70 | 1,050 | 50,000 | 47.62 | 70,000 | 66.67 | 114.29 | 120,000 |
| 80 | 1,200 | 50,000 | 41.67 | 80,000 | 66.67 | 108.33 | 130,000 |
| 90 | 1,350 | 50,000 | 37.04 | 90,000 | 66.67 | 103.70 | 140,000 |
| 100 | 1,500 | 50,000 | 33.33 | 100,000 | 66.67 | 100.00 | 150,000 |
| 110 | 1,650 | 50,000 | 30.30 | 110,000 | 66.67 | 96.96 | 160,000 |
| 120 | 1,800 | 50,000 | 27.77 | 120,000 | | 94.44 | 170,000 |

**Table 3**

| Uniform Price | | | | Operation Per Cent Capacity | Decreasing Price | | | |
|---|---|---|---|---|---|---|---|---|
| Selling Price Per Ton | Profit per Ton | Total Sales per Month | Profit per Month | | Selling Price per Ton | Profit per Ton | Total Sales per Month | Profit per Month |
| $125.00 | $ .... | $ ..... | $ ..... | ... | $... | $ ... | $ ..... | $ .... |
| ..... | ..... | ..... | ..... | ... | ... | ... | ..... | .... |
| 125.00 | 8.33 | 93,750 | 6,250 | 50 | 130 | 3.33 | 97,500 | 2,500 |
| 125.00 | 2.78 | 112,500 | 2,500 | 60 | 125 | 2.78 | 112,500 | 2,500 |
| 125.00 | 10.71 | 131,250 | 11,250 | 70 | 120 | 5.71 | 126,000 | 6,000 |
| 125.00 | 17.67 | 150,000 | 20,000 | 80 | 115 | 6.67 | 138,000 | 8,000 |
| 125.00 | 21.30 | 168,750 | 28,750 | 90 | 110 | 6.30 | 148,500 | 8,500 |
| 125.00 | 25.00 | 187,750 | 37,750 | 100 | 105 | 5.00 | 157,500 | 7,500 |
| 125.00 | 28.04 | 206,250 | 46,250 | 110 | 100 | 3.04 | 165,000 | 5,000 |
| 125.00 | 30.56 | 225,000 | 55,000 | 120 | 95 | 0.56 | 171,000 | 1,000 |

fibrous and other solid "impurities" suspended in it (to set the sizes). (2) To condition the process water so that fillers will tend to separate themselves from the water and to adhere to the fibrous materials which it is desired to remove from the water suspension (to aid in retention of fillers). (3) To perform a similar function for dissolved or suspended colors. (4) To clarify raw waters for use in manufacturing operations or for power purposes by encouraging the separation in suitable form of naturally occurring suspended matter. (5) To clarify white waters in save-alls by processing the waters so that suspended fibrous and solid bodies will separate in forms suitable for mechanical separation from the water. (6) To assist in clarifying waste waters before discharging them to streams, lakes, or other natural waters. (7) For certain special purposes.

One of the most valuable sources of information on floc forming compounds is the literature on potable water clarification. In attempting to interpret this information in terms of paper manufacture, cognizance must be taken of the fact that alum and other floc forming compounds are used in extreme dilutions in potable water clarification, whereas in many of its uses in the paper mill these floc formers are used in more moderate dilutions.

In natural waters the pH at which floc formation from alum takes place may vary slightly from a pH of 5.5, but at whatever pH the floc forms most readily, it will be found that a small variation from this pH will delay or inhibit floc formation completely. The higher concentration (400 p.p.m.) discussed by Theriault & Clark are about the lowest used in paper manufacture. With 400 p.p.m. of alum the pH range over which floc formation occurs in pure water within 10 min. extends from pH 3.6 to 6.3.

In paper manufacture the question of the completeness of precipitation of the added alum may not be of paramount importance. In the treatment of potable waters, however, it is desirable that substantially all of the aluminum ion added to the water in the form of alum be subsequently removed as alum floc both from the standpoint of cost and efficiency of floc action and also because of the undesirability, particularly from the psychological standpoint, of permitting any dissolved aluminum salts to remain in the water which is consumed by the public as drinking water.

The concentration and valency of the negative ion or ions present in solution has a marked effect upon the formation of floc and the completeness of precipitation of aluminum ion from solution.

Where alum (aluminum sulphate) is used as the source of floc the conditions for floc formation and the floc characteristics will usually be governed primarily by the negative ion simultaneously added, in this case the sulphate ion. The same statement holds true within equal or lesser limits where other acid salts of aluminum, such as aluminum chloride, are utilized. Where sodium aluminate is used as a source of floc, however, the negative ions already present in the water (particularly the polyvalent anions) will have a more pronounced effect in conditioning floc formation.

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It seems probable that, in the case of sodium aluminate (where the aluminum forms a part of the negative ion), positive ions present in the water may also have a more pronounced effect on floc formation than where alum or other compounds in which aluminum is the cation are used as a source of floc.

In order to determine definitely what effect calcium and magnesium salts present in hard waters might have upon the floc from sodium aluminate, electrometric titrations of sodium aluminate solutions by a calcium salt and by a magnesium salt have been made. Considering first the effect of calcium: it is found that the addition of calcium nitrate to sodium aluminate causes a depression of the pH but no floc formation occurs. The titrated solution after standing for 2 days, shows the presence of a small quantity of crystalline solid phase which qualitative analysis shows to be a calcium aluminate. So far as aluminate floc formation is concerned, calcium ion may be considered of minor importance.

Magnesium salts if present in sufficient quantity have a pronounced effect upon aluminate floc formation. The addition of magnesium sulphate to aluminate solution to the extent of 72 p.p.m. of the anhydrous salt causes opalescence to appear and the pH of the solution to drop 0.15 of a pH. Further addition of magnesium sulphate to the extent of 180 p.p.m. (10.6 grains per gallon) causes floc formation at a pH of 9.8. Upon further additions of magnesium sulphate the pH drops slowly and increasing amounts of floc are formed. The floc formed when magnesium sulphate is added to aluminate solution is entirely different than the floc formed upon partial acidification of aluminate solution. The magnesium sulphate-sodium aluminate floc is extremely finely divided and settles with exceeding slowness. Thus, after standing 10 minutes it is just barely possible to discern the beginning of formation of a clear layer of liquid above the floc.

From the results obtained to date it would appear that a magnesia-alumina floc would usually be something to be avoided because of its slow settling characteristics. There may be conditions and uses, however, where a highly dispersed, slow settling floc may be of value.

The electrometric titration method of investigation may be applied to other chemical substances used in paper manufacture and likewise to those chemical substances whose presence may prove a disadvantage in such manufacture. Manganese is often detrimental in paper manufacture and must therefore be removed from the raw water before it can be used in paper manufacture. Where this is done by precipitating and filtering off a manganese floc it will be necessary to maintain a pH above about 9.0 in order for removal of the manganese to occur. This has been substantiated by experience in the practice of manganese removal from potable water where it has been found that with a ferric coagulant both iron and manganese are satisfactorily removed by rapid sand filtration when a pH of 9.0 or above is maintained.

The electrometric titration of iron salts with alkalies forms a convenient method of investigating these compounds for floc forming properties. In the case of dilute solutions of ferrous salts, it is found that the additions of small quantities of alkali cause a rapid increase in pH and the appearance of floc at a pH of about 7.6. Upon the addition of one equivalent of alkali a second increase in pH is noted. From the practical viewpoint the formation of ferrous floc is of little importance since this floc is seldom used directly for water conditioning. It is of importance, however, since the rate of oxidation of the ferrous floc to ferric floc (which is made use of in water treatment) is intimately connected with the electrometric titration curve. In the case of ferric salts the electrometric titration yields information of direct value. In the case of the trivalent iron salts floc formation begins at a lower pH than with aluminum salts (the sulphates being used in both cases) thus permitting the extension of the use of ferric sulphate into more acid regions than with alum. A further difference is found in the fact that ferric floc does not redissolve at high pH values as does alum floc, thus permitting its use over much broader ranges of pH.

Similarly an investigation of chromium sulphate in dilute solutions of chrome alum indicates that chromium floc does not appear until almost 1 equivalent of alkali has been added, during the course of which addition the pH has increased from a value of 3.0 to 5.3. In other respects this floc behaves quite similarly to alum floc except that redispersion does not occur as readily as with alum. Because of its higher cost chromium floc is not made use of in water treatment in paper manufacture.

A new phase of the application of floc formation in the paper industry is now developing in connection with the use of Sveen and Adka save-alls. At the present time the methods of floc formation are largely of the rule-of-thumb type. Technical information on the subject is accumulating rapidly which will soon lead to a thorough understanding of the subject.

Many, in fact, most, soluble metallic compounds will form precipitates with alkalies. Thus aluminum, copper, iron, magnesium, beryllium, titanium, zinc, tin, cadmium, lead, cobalt, nickel, mercury, silver, chromium, and some of the rare earths all tend to form precipitates of the hydroxides in alkaline solution. Because of unsuitable properties, high cost, or because they have never been properly investigated, most of these insoluble hydroxides are not made use of in water treatment. (Recently, however, titanium salts have received attention in connection with water treatment.)

It should be pointed out that the development of scientific and technical thought on the subject of floc formation, which has taken place primarily in connection with the art of potable water clarification during the last two decades, is only now beginning to be understood and appreciated in the paper industry. The whole subject is still in the early stages of development; many phases have scarcely been touched by technical investigators. In the next decade the detailed investigation of this field will prove both instructive and useful. The application of chemical coagulants in many phases of pulp and paper manufacture will find widely increased usage.

## Some Factors Affecting the Compressive Strength of Fibre Boxes

**T. A. CARLSON, Senior Engineer, Forest Products Laboratory[1], Forest Service, U. S. Department of Agriculture.**

The compression test is perhaps the one most commonly used today for evaluating the relative efficiency of corrugated fiberboard containers.

It is well known that two lots of boxes of the same design and made from the same paper board may show widely different results in the compression test because they have been treated differently in the manufacturing processes. Many of the variables involved in these processes are recognized by box manufacturers and testing agencies, and attention is constantly being directed toward reducing or eliminating their influence as far as the strength of the box is concerned. These variables must of necessity be considered in any study of corrugated fiber boxes. The Forest Products Laboratory has encountered some of them in its study of corrugated board as an engineering material, and it is realized that they will enter into its present study of correlating the strength of the board with that of the box. For instance, in converting corrugated board into boxes, one of the operations that has a large influence on the re-

(1) Maintained at Madison, Wisconsin, in co-operation with the University of Wisconsin.

sistance of the box to compression loads is the scoring or creasing to form the edges of the box.

At this point a question might naturally arise as to whether the conditions of creasing that result in the best rigidity would also produce a creased edge that would have the greatest resistance to tearing. No general answer can be given to this question.

From the standpoint of getting the greatest rigidity from a given combination of materials, compression tests of boxes having horizontal scores that involved no crushing of the corrugations would perhaps result in the optimum theoretical rigidity. Such a score, if attainable, would avoid the crushing or rolling at the top and bottom edges of the box so that the force would be absorbed directly by the side and end faces.

There are, of course, many other factors besides the horizontal creases that affect the ability of the box to resist crushing forces. Much is known, for instance, about the influence of printing on the rigidity of the box. Also a great deal of study has been done by the industry and by testing laboratories to determine the influence on box strength of the numerous variables involved in combining the sheet materials to make corrugated board. The vertical scores, the efficiency of the body joint, and many other factors are recognized. There are also other conditions of use and loading that are related to the crushing resistance of the box. One of these is the condition in which the contents of the box are of such a nature that they are better able than the box itself to resist external crushing loads. This may be considered the other extreme of the condition in which the contents need the protection of the box against such forces.

If the commodity cannot of itself resist crushing loads, the compression test should prove of value in indicating the protection afforded to the contents as well as the stacking characteristics. With such a commodity the resistance to compression seems to devolve largely to the walls of the box. The scores, of course, have an important influence in the over-all rigidity (or lack of it) in such a box, and the optimum theoretically attainable strength and stiffness would be indicated by the tube test.

If the contents are better able than the box to withstand crushing forces, the value of the compression test lies largely in the indication of stacking qualities. With such a commodity it appears that the stacking resistance, or the top-to-bottom compression resistance, depends to a large extent on the ability of the corrugations in the top and bottom flaps to resist crushing. While the flatwise compression test of a single sheet of corrugated board may indicate the loads that can be carried flatwise by the flaps, it is also important to consider the amount of compression in the flaps and whether or not the load is evenly distributed over the surface. Both of these conditions may be affected by the handling that the flaps receive in the sealing operation, and it is apparent that any unevenness in the crushing of the corrugations in the flaps would contribute to the toppling of a stack of boxes.

It is believed that the compression test of the empty corrugated box is one of the most convenient and efficient means of


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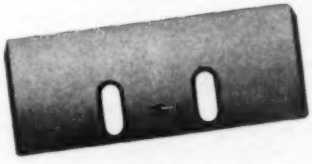

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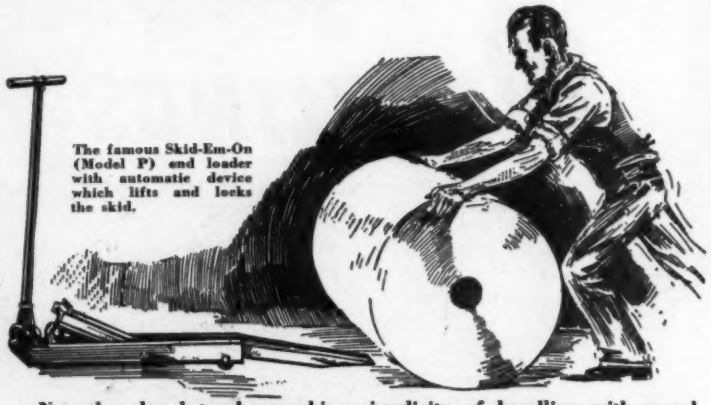

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appraising the quality of materials, the fabricating influences, and general efficiency that is built into such a box.

The use of this test in arriving at details of design and construction of corrugated boxes must take into consideration such factors as variability of component materials, effect of manufacturing variables of board and of boxes, the moisture conditions of use, and the duration of the loads to which the boxes are subjected. These factors, together with a factor of safety to provide for accidental overloads, are quite similar to those considered in any other engineering structure.

## Controlled Conditioning of Paper


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Conditioning may be defined as the altering of the moisture content of paper by the addition or subtraction under control of small increments of moisture. It matters not whether water be added in the liquid form as mist or condensation, or in the gaseous form of water vapor. To be conditioning in the true sense, however, control is implied.

In the paper mill, need for conditioning exists at a number of stages in the manufacture. As one instance conditioning may be desirable between the drier section and the machine calender stack.

Those classes of paper which are supercalendered lose a considerable amount of moisture going through the supercalender, and hence conditioning following the supercalender is desirable.

In converting plants conditioning is highly important. In the drying of a coating having organic solvents, such for example as the drying of lacquer, a considerable dehumidification of the paper takes place unless the drying is performed in an atmosphere of controlled humidity, in which case the rate of drying of the organic solvents is not affected but the moisture content of the paper may be maintained as desired. Perhaps the most common requirement and use of conditioning in converting plants is in connection with the drying of coated paper, the importance of which is sufficient to warrant subsequent individual attention.

It is especially noteworthy that conditioned paper lends itself to superior embossing or plating, the desired finish being obtained more easily and uniformly and with less waste.

Unless or until the paper mills can supply printing plants with paper of the desired moisture content the need exists for conditioning in the printing plants.

The first serious attempt to condition paper was made in coating mills. Twenty years or more ago partially successful attempts were made to condition coated paper. Most coated paper is dried in festoon racks, and the drying effect varies considerably between different points in the festoon. Fortunately, the festooning arrangement allows for having a large amount of paper in a limited space; hence, it is usually quite practicable to have a separate cooling and conditioning tunnel at the end of the drying line in which several minutes are allowable for the conditioning process.

One of the practical lessons learned in the coating mill was the impossibility of conditioning hot paper; hence, the modern arrangement is to have a cooling section followed by the conditioner section in which carefully controlled, high-humidity air is supplied.

For accurate register of successive colors in multicolor offset printing it is important that the moisture content of the paper have a definite relation to the humidity of the atmosphere in which it is printed. Work done by the U. S. National Bureau of Standards with co-operation of the Lithographic Technical Foundation, Inc. [Weber, Charles G., and Geib, Martin N. V., *Natl. Bur. Standards Research Paper* 859; *Paper Trade J.* 103, no. 12:36-40 (Sept. 17, 1936)] shows that the moisture content suffers the least change during printing if it is adjusted to approximately 0.5 per cent above equilibrium with the atmosphere in the pressroom. This is equivalent to having a moisture content in the paper in equilibrium with a relative humidity 5 per cent to 8 per cent above that in the pressroom.

Although major attention has been given to conditioning of papers for multicolor offset printing due to necessity, it is recognized that ink on ordinary book or newsprint papers is more receptive to paper of high moisture content, the only limitation being the handling of the paper, itself, as to curling and waving in the pressroom.

The action of paper in the pressroom is not dependent alone on having the proper moisture content, but it also depends on the previous moisture history.

It is a fact that if the printing plants could secure paper of the desired moisture content directly from the mills it would permit lithographers and printers to cut costs considerably.

Although it cannot be considered as conditioning, mention should be made of the marked benefit secured by having adequate cooling rolls to cool the paper at once after the drier section and before it is wound or carried to subsequent operations. Hot paper gives up its moisture to dry air in the mill to a much more serious extent than will paper which is cool.

The impracticability of conditioning on the paper machine forced the consideration of conditioning as a separate operation or in synchronism with subsequent operations. Considerable work was done studying the rate of moisture regain, both in the laboratory and with a pilot conditioner. Essentially, this type of conditioner consists of a housing through which the paper is conveyed and apparatus for supplying air to the paper and recirculating it with thermostatic and humidity control. In some instances it was found most economical to operate this type of conditioner in synchronism with a rotary cutter or sheeter, introducing it between the backstand and the cutting knife. In other instances the conditioner is operated as an entirely separate operation. The time allowed for the paper in the humid atmosphere varies from 1 to 5 seconds. The limit of moisture addition by

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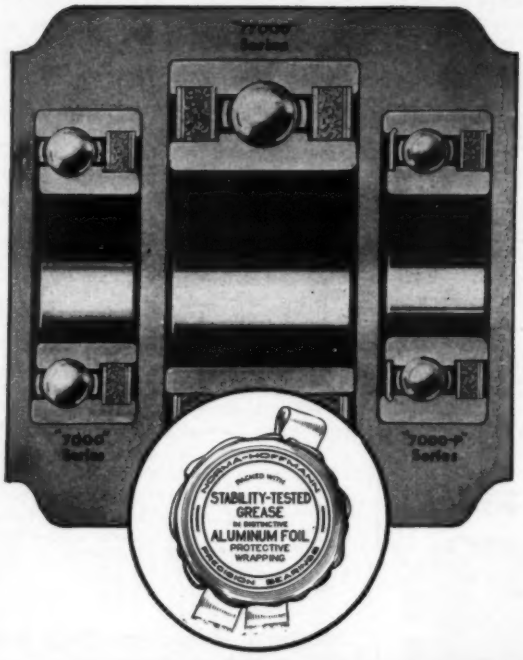


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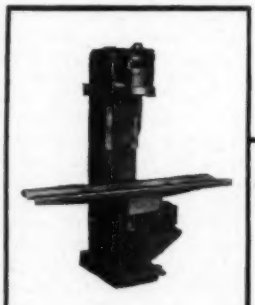

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this arrangement seems to be about 0.6 to 0.7 per cent, and even this moisture addition is possible only if the paper entering the conditioner is reasonably cool.

A variation of this type conditioner consists of adding one or more rolls cooled with water or refrigerant by means of which the possible moisture addition is considerably increased but with a decided loss of control of the moisture addition and a loss of paper when the speed has to be changed or the operation stopped.

The limitations of existing conditioners and the desirability of adding larger amounts of moisture (up to 3 per cent or more) uniformly and controllably at high speed resulted in the invention of the Cycle Conditioner which operates on a unique and new principle. There are now three of these conditioner units in regular operation and a fourth under erection so that the facts concerning its use are available.

The conditioner consists essentially of two adjoining chambers with a partition between, having slots to permit the paper to pass from one chamber to the other. In one chamber which we may call the cooling chamber there is maintained an atmosphere of cool, high humidity air. In the other chamber which may be called the conditioning chamber there is maintained an atmosphere of warm, humid air under definite temperature and humidity control. As the paper passes through these chambers the conditioned air is blown uniformly on both surfaces. The paper first enters the cooling chamber where it is thoroughly and evenly cooled, then passes into the conditioning chamber back into the cooling chamber, once more into the conditioning chamber and continues to cycle back and forth the required number of times.

Experience with the conditioner has shown it to be capable of design for adding in a practicable manner any reasonable moisture addition and at any ordinary speed, adding this moisture uniformly and controllably. The floor space needed is reasonably small because of the short time interval required. The conditioner is readily adaptable to being operated in synchronism with a supercalender stack or a rewinder. The latest installation is being made to handle paper up to 120 inches in width and at speeds up to 1000 f.p.m.

It has been found in practice with the Cycle Conditioner that the added amount of water sold with the paper will offset the operating and amortization cost of conditioning. But somehow the requirements of the customer must be met by the mills, and it may be that until all users can be prevailed upon to maintain reasonably standard and proper humidities, the mills will have to furnish what might be called custom-made paper with moisture content adjusted for the requirements of the individual user. The equipment is available for that purpose.


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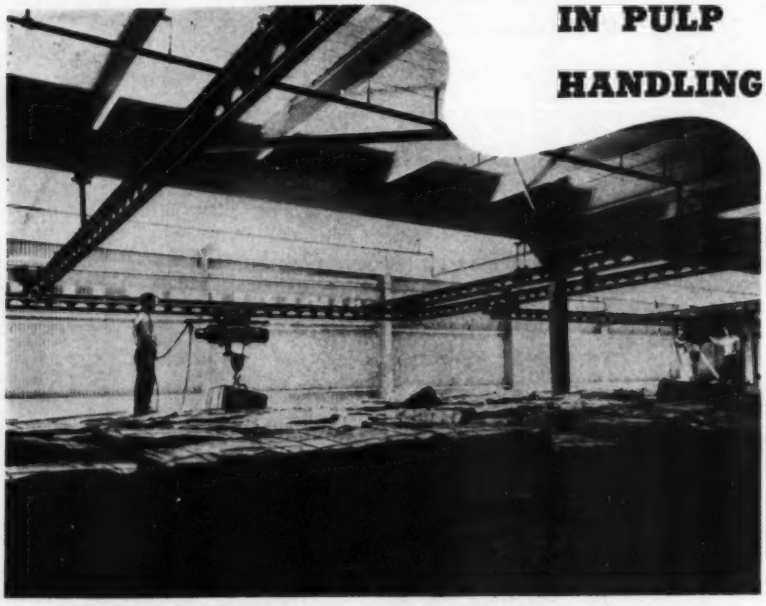

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*The "ton" of capacity as used throughout this paper should be defined. The chemical recovery unit never remotely contacts the pulp. It deals entirely with the solids in the spent liquor separated from the pulp after discharge from the digesters. Depending on the kind of wood used, whether a raw cook for paperboard pulp, a long cook for high-bleach pulp, or an intermediate cook is being used and on other factors, the weight of solids will vary over the range of about 2300 to 3400 pounds per ton of pulp produced. As used in this paper, however, this value is fixed at 3000 pounds. A 200-ton unit therefore becomes a unit with a capacity of 600,000 pounds of dry solids per 24 hours (before the addition of salt cake). To translate this into capacity in terms of "tons of pulp" as applying to any specific plant requires only that the figure of 600,000 be divided by the pounds of solids in the liquor per ton of pulp as applying to that situation.

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| Problem | Suggestions for Management |
| Hazards | Suggestions for Employees |
| Discussion | |
| Notes | |

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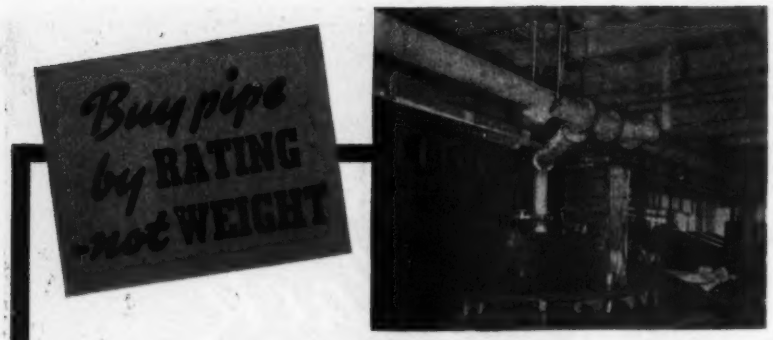


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extent of the loss of chemical involved. The solid constituent however is troublesome. Until cooled down to a temperature below 1300 deg. Fahr. it has a strong tendency to stick to everything with which it comes in contact.

In practical design the gas temperature does not fall below 1300 deg. Fahr. until it has passed over a considerable amount of boiler and superheater surface. In this zone slag adherence must be expected. It may, however, be reduced to a minimum and its character made least objectionable by using vertical tubes spaced on wide centers and arranged for a gas flow parallel thereto.

After the formation of slag has been minimized by proper design, provision should be made for hand lancing every square foot of surface through an adequate number of covered ports accessible from floors, spaced at convenient elevations.

Gas flow parallel to the tubes in contrast with right-angle flow contributes to a slow rate of contact of the suspended particles and extends the period of cooling time between deposit of successive layers. This results in a thicker layer of dust and highly porous slag and makes removal of the deposit as a whole a less frequent, a much easier, and a more effective operation than would otherwise be the case.

No great difficulty is experienced beyond the temperature zone of 1200 to 1300 deg. Fahr. Steam soot blowers are effective and their maintenance is nominal. Vertical tubes are still desirable as they afford less support for deposited chemical. Effective means for mechanically handling the deposited material from hoppers in this zone is highly desirable and is a practical achievement.

Spacing of tubes in the boiler passes beyond the superheater conforms to normal boiler practice. Material which deposits on this surface is in the form of a dry dust readily removed by mechanical soot blowers. Deposited material in the hopper below the rear passes is continuously removed and returned to the system via the cascade evaporator. A pump circulates and srays a solution of weak liquor or water and ash into the hoppers which sweep out the ash deposit and delivers it to the ash dissolving tank. The mixture is delivered in slurry form to the cascade evaporator. All manhandling and consequent dust nuisance is entirely avoided.

The liquor feed to the furnace is a mixture of inert chemicals, organic solid matter, and water.

The ratio of organic matter to inert chemical in the liquor is influenced by the character of product being produced, by the kind of wood used, and to some extent by the routine established in the specific mill. A paperboard mill using pine wood produces a liquor high in organic matter. A mill producing high-bleach pulp produces a liquor low in organic matter. The heat value will vary accordingly. Jack pine produces a higher heat-value liquor than chestnut or gum.

Liquor should be delivered to the furnace with the minimum water content—i.e., with the limit of solid content which the liquor pumps will handle—about 70 per cent. Actual operation may, with good design and reasonable supervision, be maintained within 5 per cent of this value or at a minimum of 65 per cent. Natural circulation multi-effect evaporating equipment can be operated to deliver liquor with 55 per cent solids, perhaps a little more. They are being operated in modern mills over a range of 45 to 55 per cent. The difference between the amount of water delivered by the multi-effect evaporating plant and the amount delivered to the furnace is the evaporative function of the cascade evaporator. This unit derives its evaporating capacity entirely from the hot gases delivered to it from the boiler.

Liquor to the salt cake mixing tank from the cascade evaporator is at a temperature of 180 to 190 deg. Fahr. This temperature is influenced little by temperature of inlet and outlet gas or by the inlet liquor temperature. To obtain the maximum fluidity and promote flow to the suction of the liquor pump the liquor is heated in the pipe between the outlet of the mixing tank and the pump suction. The heating is accomplished by direct contact steam to a little over 200 deg. Fahr. A second heater raises the temperature to some established desirable temperature on the discharge side of the pump. Between 0.03 and 0.05 pound of low pressure steam per pound of solids in the liquor is consumed in this process.

Liquor is delivered to the furnace through two nozzles at each end directed along the axis parallel to the side walls. To obtain an even distribution over the whole cross section of the furnace the nozzles are preferably given a slow rocking motion in a vertical plane.

The extent to which the moisture is removed before the sprayed particles land on the hearth below is not known. Since the particles are not of uniform size it is unlikely that the drying is uniform. The temperature, to which the liquor is elevated before spraying, is an important factor in the drying process. It is limited to the minimum required to establish stable furnace conditions. Excess temperature causes unnecessary expansion of suspended particles and tends to aggravate entrainment in the gas stream.

Correctly designed equipment, skillfully operated, is capable of reducing as much as 98 per cent of the sulphur supplied to the furnace as a sulphate to sulphide. Normally 92 to 96 per cent reduction is obtained.

A belt of air ports near the furnace bottom provides the restricted air supply essential to the reduction process. A second row of ports at an elevated position but below the sprays supplies the air for promoting the high temperature zone required for drying. Tertiary air is supplied through high-powered jets at the furnace ends, jets which may be combined with auxiliary oil burners if the possibility of operating the boiler on oil under emergency mill conditions is desired. This air gives a vigorous lateral stirring of the fuel-air mixture and completes the combustion process with the minimum excess. Being admitted above the sprays it contributes little to the entrainment of suspended chemical.

Stack loss of chemical with all types of furnaces is a substantial amount. The sus-

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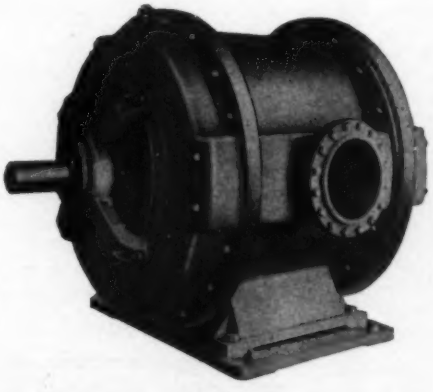

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pended solids can be and are effectively recovered by mechanical and scrubbing means. The sublimate passes through all such devices to the stack and constitutes the major item of loss, at least 100 pounds per ton of pulp. Electric precipitation has proved effective in its recovery.

Steam, the by-product of the chemical recovery process, is an important item in the economic balance. It should be remembered, however, that it is a by-product and not the main issue. Many of the heat losses are inherent in the process and beyond the control of either the designer or the operator of the recovery equipment.

Steam productions consistent with heat balance figures are being attained.

It is too early in the history of operation of units built with completely bare metal-walled furnaces to have accumulated maintenance figures. It seems certain, however, that this will be only a few cents per ton of pulp produced. The only exposure of refractory material is on the furnace bottom, and indications to date are that there will be no waste of this material.

## Solubility of Chlorine in Water


ROY P. WHITNEY[1] and
J. EDWARD VIVIAN[2]


Experimental data on the solubility of chlorine in water are few and are of little value in the range encountered in the production of chlorine water bleach from electrolytic cell gas. In previous work, Whitney and Vivian used the solubility data of Adams and Edmonds [Adams, F. W., and Edmonds, R. G., *Ind. Eng. Chem.* 29, 447, (1939)] which were calculated from Arkadiev's equations [Arkadiev, V., *J. Russ. Phys.-Chem. Soc.*, 50, 205, (1918)], using the experimental data of Yakovkin [Yakovkin, A., *J. Russ. Phys.-Chem. Soc.*, 32, 673, (1900)] on the hydrolysis constant for chlorine in water. Because they were calculated and not experimental, it was stated that these data should be checked by a direct method. Since that time, the solubility or chlorine in water has been determined experimentally in this laboratory over the range of temperature and concentration commonly encountered in the preparation of bleaching solutions.

The experimental procedure consisted essentially of the bubbling of a gas mixture of chlorine and nitrogen of constant composition through chlorine water contained in a glass cell, until equilibrium between the two phases had been reached. Then, by analysis of the liquor and of the exhaust gas, the solubility of chlorine under those particular conditions of temperature and chlorine pressure was determined.

The results obtained in this investigation are shown in Table 1.

Some experimental data on the solubility of chlorine in water are reported in the International Critical Tables (International Critical Tables, vol. III, 256, New York, McGraw-Hill Book Co., 1928). A comparison of these data with those of this investigation is shown in Table 2. At the four temperatures investigated, the greatest deviation is 1.1 per cent.

Because the new solubility data are considered to be more reliable, they should be used in design calculations.

TABLE 1

| Temp. deg. C. | Chlorine Pressure atmos. | Solubility g. per liter |
|---|---|---|
| 10 | 0.060 | 1.24 |
| | 0.066 | 1.31 |
| | 0.155 | 2.28 |
| | 0.157 | 2.37 |
| | 0.292 | 3.68 |
| | 0.293 | 3.66 |
| | 0.498 | 5.41 |
| | 0.498 | 5.55 |
| 15 | 0.058 | 1.11 |
| | 0.061 | 1.15 |
| | 0.140 | 1.95 |
| | 0.145 | 2.01 |
| | 0.291 | 3.30 |
| | 0.297 | 3.30 |
| | 0.488 | 4.77 |
| | 0.490 | 4.80 |
| | 0.951 | 8.25 |
| | 0.951 | 8.25 |
| 20 | 0.067 | 1.12 |
| | 0.120 | 1.60 |
| | 0.260 | 2.62 |
| | 0.260 | 2.65 |
| | 0.487 | 4.15 |
| | 0.490 | 4.22 |
| | 0.965 | 7.25 |
| 25 | 0.062 | 1.04 |
| | 0.066 | 1.06 |
| | 0.104 | 1.39 |
| | 0.109 | 1.43 |
| | 0.174 | 1.89 |
| | 0.270 | 2.46 |
| | 0.551 | 3.91 |
| | 0.589 | 4.18 |
| | 0.961 | 6.26 |

TABLE 2

| Temp. deg. C. | $Cl_2$ Press. atmo. | ICT Data g./ liter | This Investigation g./ liter | Deviation % |
|---|---|---|---|---|
| 10 | 0.989 | 9.95 | 9.92 | —0.3 |
| 15 | 0.983 | 8.49 | 8.46 | —0.4 |
| 20 | 0.978 | 7.29 | 7.32 | +0.4 |
| 25 | 0.973 | 6.40 | 6.33 | —1.1 |


(1) Asst. Prof. of Chem. Eng., Director, Bangor Station, Massachusetts Institute of Technology School of Chemical Engineering Practice.
(2) Asst. Director, Bangor Station, Massachusetts Institute of Technology School of Chemical Engineering Practice.


## Some Applications of Statistical Methods to the Interpretation of Routine Tests


T. A. PASCOE[1] and MARIAN FRASER[2]


Since pulp and paper routine test data are notoriously variable because of the inherent variability of pulp as a biological material, the statistical methods dealing with variability are eminently fitted for bringing order out of an unintelligible chaos. Methods involving the reduction of large bodies


(1) Technical director and (2) statistician, Technical Department, Nekoosa-Edwards Paper Company.

• View of Johnson Joints installed at Bedford Pulp & Paper Mill Co., Inc., Big Island, Va. No more steam fit troubles here.

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To win this widespread acceptance in just a few years, the Johnson Joint had to offer substantial benefits. It put an end to the constant oiling, adjusting and repacking of steam fits. It stopped the menace of misalignment, which wears old style steam fits so rapidly. More than that, it offered a simpler, neater way to provide for syphon drainage. There's a freedom of lateral movement built right in the Johnson Joint, to keep syphon pipe from rubbing on dryer journals.

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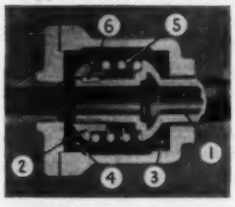


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of data to a few significant values can be of real assistance.

The use of statistical methods allows the reduction of numerous test results made on highly variable materials with not very accurate test methods to a few valid conclusions of measured reliability.

The first study made involved the test results from 45 paired tests on spruce sulphite, unbleached and bleached. The original object of this study was to investigate the vague theory that has been held in some quarters that bleachability of sulphite pulps was related to the strength of the pulp. Accordingly, means, standard deviations, coefficients of variability, and correlation coefficients showing the relation between bleach value and each of the variables were calculated.

In considering the paired means from each series, there is a suggestion that pulp strength is being lost in the bleaching process.

The paired standard deviations suggest either that the bleached pulps are somewhat less variable than the parent unbleached pulps or that they lend themselves to testing in such fashion that inherent variabilities of the method are smaller.

The coefficients of correlation of bleach value with each of the other tests are of unusual interest because of the rather startling and far reaching conclusions that can be drawn from this information. The general magnitude of the coefficients when considered in relation to their standard errors leads at once to the confirmation of the original theory that bleach value is related to pulp strength. Further consideration of these coefficients show that there is a considerably higher degree of association between pulp value and bursting strength than there is for tearing strength.

The main object of the second investigation was to determine the effect on the pulp strength and uniformity of quality due to the installation of a positive circulating system on a sulphite digester. A further object was to confirm the results from the previous study.

The material for this investigation consisted of 49 routine laboratory pulp tests on unbleached spruce sulphite pulps cooked in one digester before the circulating system was installed and 49 cooks on the same species after the system was installed. No effort was made to exercise any control over the wood used during either period. The standard for bleachability was the same for both periods.

The statistical emphasis was shifted from a general exploratory study to a consideration of differences between the means of corresponding tests in the two series and the significance of these differences.

The conclusion could be drawn that the installation of the circulating system had resulted in an increase in pulp strength. A second conclusion is that the pulps were more uniform with respect to strength variations from cook to cook as a result of using the circulating system than were the pulps produced with the noncirculating equipment.

It should be pointed out that whereas the present example involved the effects of altering the circulation in the digester, the same statistical treatment could be employed to study the effects of any other change in cooking or in any other process. It was found, however, that the positive correlation between strength and bleach value disappeared in the case of pulps cooked with the circulating system.

A word regarding the testing of the various statistics for significance should be in order at this point. There are no definite rules on which all workers agree or that cover all circumstances. For practical purposes a minimum of twice the value of the standard error or three times the probable error is considered necessary in order to render a statistic significant. The number of tests being considered have a bearing on the reliability of statistics calculated therefrom. The general reliability of a statistic is related to the square root of the number of tests involved. A more accurate test for significance is the *t* test. This test has been discussed in an understandable manner by Goulden (Goulden, C. H. "Methods of Statistical Analysis," pp. 40, 72, New York, John Wiley and Son. 1939). A table of values for *t* and the corresponding levels of probability occurs in most of the standard works on statistics.

*(Acknowledgment: The authors are indebted to the management of Nekoosa-Edward Paper Co. for permission to publish the information contained in this paper.)*

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## The Effect of Washing on the Strength of Bleached Sulphate Pulp

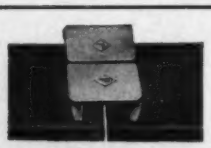
E. H. SMITH[1], A. B. MOORE, JR.[2] and K. G. CHESLEY[3]

A large amount of work has been done recently on the bleaching of sulphate pulps. The effects of temperature, concentration, pH, and catalysts for various bleaching systems have been studied. The effect of improper washings on the various operations and on the properties of the finished products does not seem to have received as much investigation as it deserves. The practice in industry has been to attempt to offset improper washing by at all times having an excess of wash water. The engineering standards developed for quantities of wash water have in some instances stalled a planned bleaching plant development because of the high cost of producing adequate water.

The data reported here are the results of a study on the strength properties of bleached sulphate pulp given various washing treatments.

The procedure was as follows: pulp of 75 brightness was sampled from various places in the system following the final hypochlorite bleach. A portion was beaten for 45 minutes in a laboratory beater. This stock was divided into 1-liter portions. One portion was allowed to stand 24 hours, then filtered for the oxygen number determination. To the other samples 1 per cent of a combined rosin size and varying amounts of alum were added. Handsheets were made and bursting strength and tearing resistance was determined on each according to methods T 403 m-36 and T 414 m-40. Schopper-Riegler freeness and pH determinations by means of an electrolytic pH indicator were made. Other portions of the original sample were soaked for varying periods of time in water at room temperature, then washed and tested as above. The samples to be tested for organic matter were all made up to 2 per cent

(1) Chemist, (2) Technical Director, (3) Research Chemist, Crossett Paper Mills.

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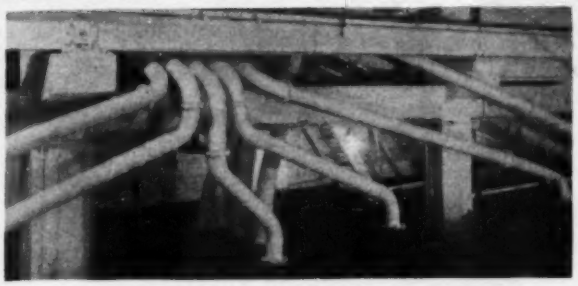

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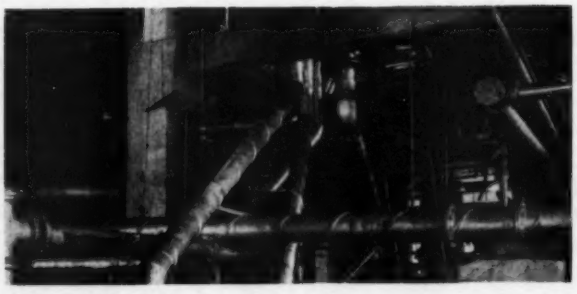

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moisture-free consistency and allowed to stand 24 hours before filtering. This period of time was found to be necessary to obtain reproducible results. All beating and freeness tests were made with untreated mill supply water with a methyl orange alkalinity of about 220 parts per million calculated as $CaCO_3$.

Pulps were examined possessing an oxygen number of from 14, for a pulp direct from the washer after the final hypochlorite, to 5 for a pulp after 24 hours soaking and washing. No measureable or reproducible difference was found in either the burst or tear for any given furnish made from these pulps. Differences were found in the amount of alum required to bring the stock to a given pH. In every instance an increase in soaking time and lowering of the oxygen number resulted in less alum being required. An interesting relation was found between the amount of alum added and the strength properties.

Other than the added cost of alum when running a poorly washed pulp to a predetermined pH the possibility of strength loss must be taken into account. If the furnish is requiring enough alum to be past the critical point anything which causes more to be required will lower the bursting strength and slow the stock. The obvious conclusions are that in order to reach the ultimate control over operating conditions both in bleaching and in stuff preparation serious thought must be given to the indirect as well as the direct effects of residual organic matter and the mineral composition of the process water.

**The accompanying abridgments are of papers presented at the Division of Cellulose Chemistry, of the American Chemical Society, St. Louis, Missouri, April 7-11, 1941.**

## Structural Factors Contributing to the Directional Shrinking and Swelling Variations of Wood

GEORGE J. RITTER*

Microscopical and X-ray data are cited to show how the cellulose crystallites are arranged in the ray cells, and in the secondary and the primary layers of the fiber wall. The data indicate that the explanation, which assumes that the ray cells restrain wood from shrinking and swelling radially, is erroneous.

The fundamental reason why wood shrinks and swells less radially than tangentially should be attributed, according to the data, to the arrangement of the cellulose crystallites. Differences between the external swelling of woods of different densities are discussed from the standpoint of the crystallite arrangement.

*Forest Products Laboratory, Forest Service, U. S. Department of Agriculture.

## Investigation of the Properties of Cellulose Oxidized by Nitrogen Dioxide

I. C. C. UNRUH and W. O. KENYON

A series of oxidized celluloses of combined carboxyl group contents from 5.8 to 25.3 per cent, prepared by the action of $NO_2$ on cellulose, were analyzed for carboxyl by several methods. The results indicate that the carboxyl groups are present as uronic acid. Acetylation data and furfuraldehyde evolution are in agreement with these results. The products appear to consist of anhydro glucose units and anhydro glucuronic acid units.

## Shrinkage and Cell Wall Structure of Cotton Fibers

EARL E. BERKLEY*

In order to obtain a better understanding of the structure of cotton fibers in the range between the particle size observable in the microscope and that measurable by means of X-ray technique, a study of shrinkage was undertaken. Green cotton fibers between the ages of 10 and 28 days were dropped into boiling water for 5 to 10 minutes and then used immediately or preserved in about 70 per cent alcohol until used. Longitudinal shrinkage of these fibers when dried showed a gradual decrease from the tenth day until secondary thickening began. The shrinkage decreased rapidly for the following two to five days, after which little change was noted. The percent shrinkage was increased by extracting the fiber with hot 95 per cent alcohol to remove the waxes and further increased by extractions with certain solvents to remove the pectic substances. A large percentage of the primary wall appeared to dissolve in hot sodium hydroxide.

The results show that in the primary wall the crystalline cellulose lies with its major axis transverse to that of the fiber. They further indicate that a large percentage of the primary wall is amorphous material, presumably cellulose in which the fine crystals of cellulose are dispersed. The removal of waxes and pectins from the cellulose matrix appears to leave voids which collapse upon drying.

*Bureau of Plant Industry and Agricultural Marketing Service, U. S. Department of Agriculture.

## Formation of Cellulose Crystallites in Plastids of Living Plants

WANDA K. FARR, American Cyanamid Company

The formation of sugar from inorganic substances takes place in the chloroplasts of living plant cells. A chloroplast is a distinct organic structure separated from the other protoplasmic contents by a membrane. When the amount of sugar produced becomes excessive, it is converted, within the chloroplast, into starch in the form of crystalline grains.

Through the activity of living protoplasm, sugar is also converted into crystalline granules of cellulose. When these cellulose particles were identified in living protoplasm in 1934, no clue was obtained as to a particular organic structure in which this conversion takes place. Cellulose-forming chloroplasts and colorless plastids are now identified in which the operation of a process contributing uniformity in size and shape to the cellulose crystallites is clearly visible.

The cellulose particles embedded in the plastid plasma are freed into the protoplasm by the rupture of the plastid membrane. In the cell wall the cellulose particles constitute the crystalline phase and the plastid plasma, often including even the chlorophyll, is represented in the intercrystalline phase. These observations extend the information as to certain physical aspects of cellulose formation and confirm our earlier conclusions as to the formation and structure of the cell wall.

## The Action of Light on Cellulose. VI. A Method for the Measurement of the Osmotic Pressure of Colloidal Solutions

RALPH E. MONTONNA and L. T. JILK, University of Minnesota

In studying the action of light on cellulose and its derivatives, it was desirable to have a rapid and accurate method of measuring the average particle size which was independent of solvation and could be carried out in organic solvents at room temperatures. The static methods were too slow and at high pressures in organic solvents resulted in injury to the membranes. By suitable modification of the apparatus

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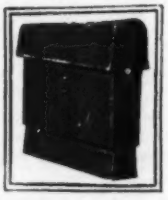

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designed by van Campen for the dynamic method of Berkeley and Hartley, accurate and rapid determinations of the particle weight of colloidal dispersoids could be attained. The apparatus is described in detail and the method of use in this type of measurement. For acetone solutions of cellulose derivatives, denitrated collodion membranes prepared according to a definite standard procedure proved quite satisfactory. The method of preparation of these membranes is described.

## The Hydrolysis and Catalytic Oxidation of Cellulosic Materials. III. The Rates of Hydrolysis of Cotton Mercerized With and Without Tension

R. F. NICKERSON, Mellon Institute

The effects of mercerization with sodium hydroxide on the behavior of cottons toward an aqueous acid-catalyst mixture are examined. This new method depends upon the digestion of cellulose in hydrochloric acid-ferric chloride reagent; the glucose set free by hydrolysis is rapidly oxidized. The evolved carbon dioxide, determined periodically during a 7-hour run, is convertible to percentages of cellulose broken down.

The data indicate that both mercerized and unmercerized cottons consist of two structural components, one of which splits out during hydrolysis, and an acid-resistant residue which probably represents crystallites. Mercerization increases the proportion of accessible or amorphous cellulose. From a consideration of the augmented physical properties and chemical reactivity which accompanies the increased amorphousness, the conclusion is reached, in agreement with other investigators, that many of the characteristics of cellulose are intimately related to the amounts of crystalline and amorphous components. The method appears to be suitable for determining the distribution between the latter states.

## Pectic Materials and Hemicelluloses From Cottonwood, Populus Macdougali

ERNEST ANDERSON, ROBERT B. KASTER, and MILLARD SEELEY, University of Arizona

Hemicelluloses and pectic materials were isolated from cottonwood, *Populus Macdougali*, which was known to be the growth of the preceding season. The materials isolated before chlorination of the wood gave a blue coloration with iodine solution, while those isolated after chlorination of the wood gave no coloration with iodine.

Analysis and hydrolysis of the hemicelluloses showed that they consisted of a monomethyl uronic acid combined with from approximately 6 to 10 molecules of *d*-xylose. They are similar to, but of smaller molecular size than the hemicelluloses previously isolated from other more mature hardwoods.

The purified pectic materials obtained had the general physical and chemical properties of pectic acid.

## Purified Wood Cellulose for Use in the Manufacture of Smokeless Powder

L. M. SHELDON and FRED OLSON, Western Cartridge Company

High alpha-cellulose content wood pulp, substantially equal in purity with cotton linters, has been found satisfactory for use in the manufacture of smokeless powder. Several economies result from the use of purified wood pulps of about 98 per cent alpha-cellulose content that cannot be attained with less pure wood pulps. This type of cellulose can be converted into stable, solvent-free smokeless powder in about 24 hours.

## Estimation of Reducing Groups in Cellulosic Materials

MILTON HARRIS*, A. R. MARTIN*, and LEONARD SMITH*

The reducing groups in cellulosic materials may be readily estimated by a modification of the method of Bergmann and Machemer. Investigation of the rates of oxidation by iodine of a series of hydrocelluloses at 0 deg. C. and pH 10.6 showed that there is an initial rapid reaction with iodine during the first hour, followed by a secondary reaction during which iodine is consumed at a very much slower but practically constant rate. Standard A.C.S. cellulose (cotton) shows only a very slight initial reaction with iodine, but after approximately 1 hour exhibits a secondary reaction of the same rate as the hydrocelluloses. By applying a correction for the amount of iodine consumed in the secondary reaction, it is possible to estimate the iodine utilized in the oxidation of reducing groups. Since iodine utilized in this way apparently oxidizes aldehydic to carboxylic groups, an independent check is readily obtained by estimation of the carboxyl groups thus formed by titration with silver *o*-nitrophenolate.

The amount of iodine absorbed by the degraded cellulose allows one to follow quantitatively the mechanism of the hydrolysis. Freundenberg, Kuhn, et al., have investigated kinetically the hydrolysis of cellulose with sulphuric acid at high degrees of cleavage and have focused their attention on low molecular weight cleavage products, such as cellotriose, cellobiose, and biosan. The improved experimental accuracy of the iodine method has permitted the extension of this kinetic study into the truly high polymeric field of the hydrocelluloses. Our experiments give rate constants of the order $10^{-4}$ in reasonable agreement with the constants of Freundenberg, Kuhn, et al.

*Research Laboratory of the Textile Foundation, National Bureau of Standards, Washington.

## The Oxidation of Cellulose by Nitrogen Dioxide

E. C. YACKEL and W. O. KENYON, Eastman Kodak Company

Cellulose has been oxidized by means of nitrogen dioxide to produce a series of oxidized celluloses of various carboxyl group contents. Even at high degrees of oxidation the products retain a fibrous structure. Procedures for analyzing these materials by the calcium acetate and the $CO_2$ evolution method and the results obtained are given. Above a carboxyl group content of about 13 per cent, these oxidized celluloses dissolve quickly and completely in 2 per cent aqueous alkali at room temperature. The properties of this type of oxidized cellulose and of its salts are described and discussed.

## A Convenient Six-tube Vapor Sorption Apparatus

ALFRED J. STAMM* and SAMUEL A. WOODRUFF*

An improved compact six-tube sorption apparatus is described for sorption measurements under evacuated conditions. Adsorption and desorption measurements at 20 deg. C. are given for unextracted white spruce wood, a commercial bleached sulphite pulp, and a cotton linters alpha-cellulose. The data indicate that the ratio of the adsorption moisture contents is constant over a large part of the relative vapor pressure cycle and that the ratios for the different cellulosic materials are similar. This is similar to the findings of Seboeg for sorption measurements in the presence of air.

*Forest Products Laboratory, Forest Service, U. S. Department of Agriculture, Madison, Wisconsin.

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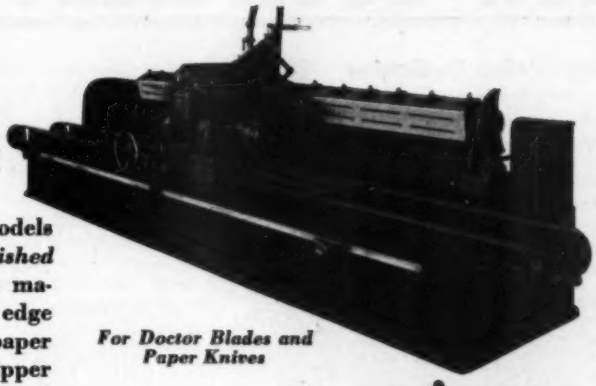

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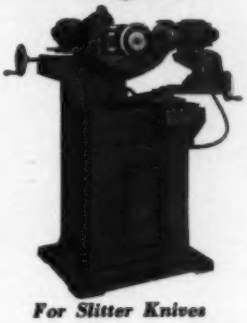

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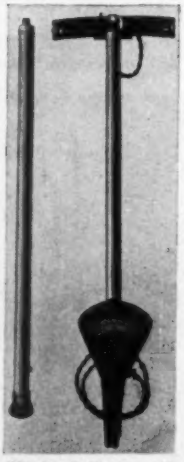

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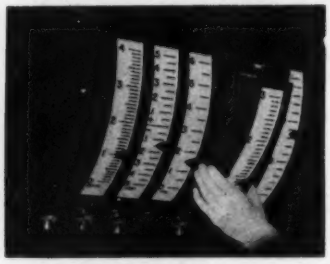
## Multi-Point Indicator

A new multi-point indicator for indicating drafts, pressures, differentials, and other factors in boiler and industrial furnace operations has been placed on the market by Republic Flow Meters Co., 2240 Diversey Parkway, Chicago. The indicator is supplied with from 2 to 16 interchangeable gage units, and is built for either flush or projected mounting. Zero adjustments



and all piping connections for each gage unit are accessible from the front of the panel, and each unit is designed to be withdrawn without disturbing other units. Each gage is actuated by a dry-bellows type of diaphragm for ranges from 0 to 50 in. of water or by a helical element for pressures above 50 in. of water. The gages have 12 in. vertical, translucent, rear-illuminated scales.

## New Line of V-Belts

The Cincinnati Rubber Mfg. Co., Cincinnati, has announced a line of multiple V-belts that includes all standard sizes as regularly required. Two construction features of these belts are: (1) a heavy elastic fabric envelope; and (2) a cord section of high tensile strength, low stretch

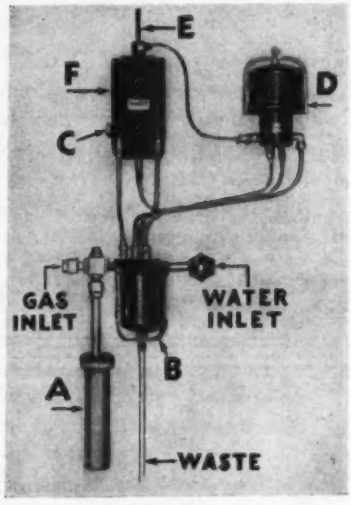
cords impregnated with liquid rubber and then imbedded in a cushion of rubber. According to the manufacturer, the fabric envelope takes up the outside wear, permits ready flexing, and holds tightly to the groove; the cord section provides lengthwise flexibility and easy flexing around the pulleys.

## Automatic Oxygen Recorder

A completely automatic oxygen recorder, which operates from an electric supply line and provides continuous indication and graphic record of the amount of oxygen in any gas, has been announced by Cambridge Instrument Company, Inc., Grand Central Terminal, New York City. The standard range of the instrument is 0 to 5 per cent oxygen on a 10 in. scale; but it can be scaled in ranges of 0 to 2 per cent oxygen full scale and 0 to 100 per cent oxygen full scale.

Operation of the instrument is simple. (See accompanying illustration.) Gas is drawn into the analyzer by a bubbler-aspirator B, the condensate falling into drip pot A. The incoming gas divides into two streams, one flowing directly to the aspirator and acting as a line purge, the other flowing through a secondary filter and orifice C, and thence to an inner bubbling tube in the aspirator.

The gas sample is collected by an inner bell in the bubbler and from there it passes to one side of the analyzing cell D, then flows through tube E in the furnace,




back through the other side of the analyzing cell and then to the bubbler-aspirator where it goes to waste along with the main gas stream.

The center tube E of the furnace contains a carbon rod heated so that any oxygen in the gas passing over it is converted to $CO_2$.

One side of the analysis cell D is exposed to the original gas containing oxygen, while the other side is exposed to the same gas, with the exception that the $O_2$ has been converted to $CO_2$. The meter unit is arranged to measure the difference in thermal conductivity between the gases on the two sides, which is proportional to the oxygen concentration of the original gas.

## Tap Water Set Inks

New inks which set with plain tap water have been announced by the International Printing Ink Division of Interchemical Corporation, 75 Varick St., New York, N. Y. The water is applied as a vapor, either in a spray or as steam. The inks, sold under the name *Vaposet*, are expected by the manufacturer to be particularly well-suited for printing containers, cartons, breadwrappers, drinking cups, paper bags, and labels. The inks may be used on flatbed presses as well as on web-fed equipment.

## Self-Contained Lubrication Units

S. F. Bowser & Company, Inc., Fort Wayne, Ind., has announced the development of a line of self-contained lubricating units. The line, made in numerous sizes and in several types, includes units with either one or two receiving tanks. Units

with two receiving tanks are recommended by the manufacturer for installations where quantities of sludge, water, or other foreign substances are present in the oil. Briefly, the units store the oil, pump it, filter it, and circulate it to the machine—the two-tank units permitting the foreign substances in one batch of oil to precipitate while the clean oil in the other tank is being circulated through the system. Tanks are of welded plate steel construction. Some models are equipped with alarms to indicate when filter cleaning is necessary; they also show the amount of oil in the tanks.

## Built-In Safety Control for Turbines

General Electric Company, Schenectady, N. Y., has announced the development of a built-in, combined trip and throttle valve for its *Type D* turbine. An easily accessible Monel-metal, basket-type steam strainer around the valve prevents foreign material

from entering the turbine. The Type D turbine, available in capacities from 5 to 2000 hp. and in speeds from 1000 to 5000 r.p.m., is of the single-stage impulse type, each wheel carrying two rows of rotating buckets. Steam admission nozzles direct the initial steam flow to the first row of buckets. Stationary buckets reverse the

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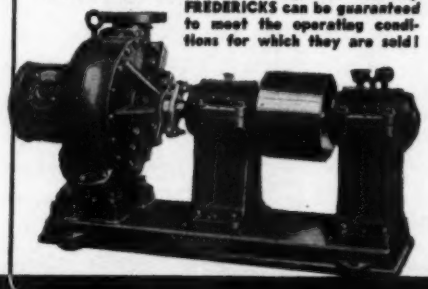

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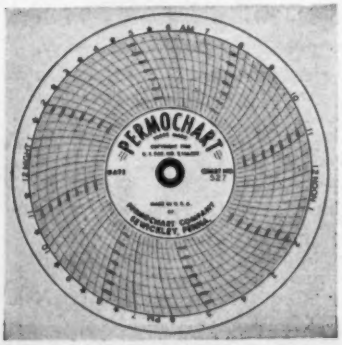
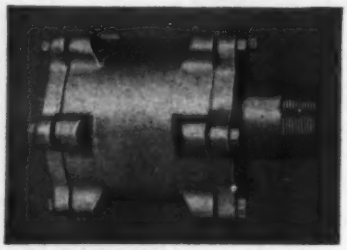



Special charts can be made upon request.

## Rotary Pressure Joint

A new design of the patented Johnson rotary pressure joint has been announced by The Johnson Corporation, Three Rivers, Mich. This joint, known as *Type R* and incorporating renewable wearing plates in its design, is offered in 3, 4, 5 and 6 in.



sizes. All sizes are rated for 150 lb. maximum pressure. Sealing of the joint is accomplished by a carbon-graphite ring which is self-lubricating. The joint also compensates for both lateral and angular misalignment. Pressure passing through the joint is the sealing force.

## Synthetic Organic Coatings

Heresite & Chemical Company, Manitowoc, Wisconsin, has developed a line of synthetic coatings, known as *Heresite,* for application to any metal as a corrosion preventative. Application may be baked-on or air-dried. Available in colors, the coatings have been suggested by the manufacturer for applications to beater tubs, vats, tanks, rolls, fans and blowers, and other equipment subject to the corrosive action of acids, alkalies, or solvents.

## Condenser for Steam Power Plants

D. J. Murray Mfg. Co., Wausau, Wis., has announced a condenser, known as the *Murray "Grid"*, for steam power plant application to maintain required uniform boiler room temperatures for draft purpose and uniform air movement without stratification. Available in a wide range of sizes

and combinations, the manufacturer states that the condenser is immune to atmospheric corrosion, is easy to keep clean, and is guaranteed for 250 lb. steam pressure; and that no electrolysis can develop in it.

*(Editor's Note: The above illustration inadvertently was used in connection with item entitled "Blast Coils for Heating," which appeared on page 1318 of the March, 1941 issue.)*

## Non-Staining Packing

A non-staining, snow-white packing, known as *Klero,* has been announced by Greene, Tweed & Co., 101 Park Ave., New York, N. Y. This packing is of braid-over-braid construction; is made from asbestos yarn; and is suitable for high temperatures. It has an odorless, tasteless, edible and chemically resistant lubricant.

## Fingerless Handguard

A chrome leather fingerless handguard has been designed by the Industrial Gloves Company, Danville, Ill. Made in small, medium, and large sizes and with adjustable snap buttons for fastening at the back, the handguard may be had in pairs, or for left or right hand only as required. It is suggested by the manufacturer for use wherever protection is required for palm only, with fingers and thumb left free.

## Safety Steel Floor Mat

Wm. F. Klemp Co., 6601 S. Melvina Ave., Chicago, has announced a steel safety mat that has a non-skid grid and that can be rolled up like a rug. The mat, made from ⅜ in. x .065 steel and formed into a

1¼ in. by 1¼ in. mesh, can be furnished to any length up to 25 ft., to any width up to 6 ft.; or in multiples of these dimensions. Butt joining of the ends of adjacent mats is accomplished with a single stringing wire for each connection. The mats can be electro-galvanized when so specified.

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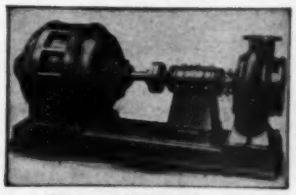
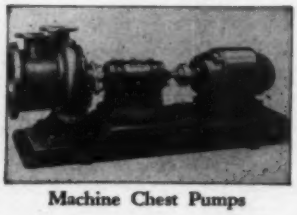
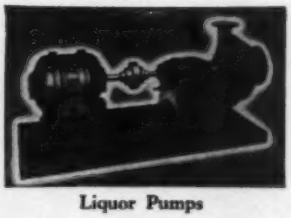


Warren Stock Pumps



Machine Chest Pumps

Centrifugal Fresh Water Pumps



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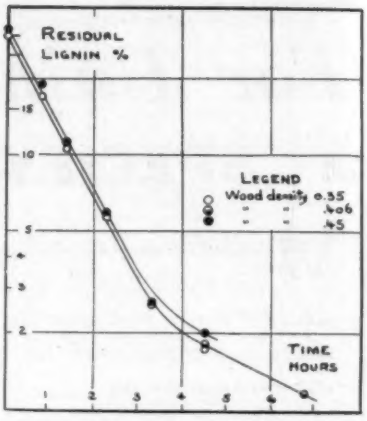
# TECHNICAL DEVELOPMENTS

**The following abstracts are of the latest developments found in the foreign press.**

## Mechanism of alkaline delignification

Up to the present the actual physico-chemical mechanism of delignification has been in part obscure. The present authors made measurements of the rate of delignification of spruce wood with lithium, barium, sodium, potassium, and tetrethylammonium hydroxides under very closely controlled conditions of concentration and temperature. The mechanism of the process is not simple because of the heterogeneity of wood, but the rate of lignin solution in alkali appears to be the governing factor in alkaline pulping. The increase in the rate of delignification with temperature increase, follows the course predicted by the activation theory of Arrhenius. Secondary factors might be the size and shape of the chip, density and moisture content of the wood, but most of those have been investigated and disposed of. Evidently the rate of delignification is the same irrespective of the size of sample (from wood flour up to chips having a 10 mm thickness). Wood density has no effect on delignification except what might be expected from higher lignin content of denser woods.

Moisture in chips was without marked effect, as were wetting agents used to help the rate of penetration. Rate of reaction studies indicated that this was largely a first order reaction, with a definite velocity constant for each set of experimental conditions. To discover what factors actually controlled the reaction rate, the following variables were studied:—ionic properties of the cation, concentration of the hydroxyl ion, absorption of the alkali at the reaction interface, and influence of temperature on the reaction rate. When the time rate of delignification with 2 *M* NaOH at 160 deg. C. was studied and the lignin percentage remaining in the pulp was plotted on a log scale against time, a linear relationship obtained until only about 2% lignin remained in the pulp. (See illustration) The last 2% did not follow the monomolecular law, but was removed much more




slowly, as indicated by a break in the curve. The velocity constants shows that for the bases studied the following is the order of increasing reactivity:—LiOH,$Ba(OH)_2$, NaOH,KOH, tetraethylammonium hydroxide. Sufficient OH- ion concentration must insure a *p*H of 12-13, but the reaction rate is also contingent on some special property of the cation employed (other than the degree of dissociation). The reaction rates were compared with ionic mobilities and adsorption coefficients of the alkalis. Experimental evidence is presented that the adsorption of alkali at the reaction interface is the determining factor in setting the rate of delignification. At the solid lignin surface there appear to be three separate stages in the reaction. (1) The acidic phenolic groups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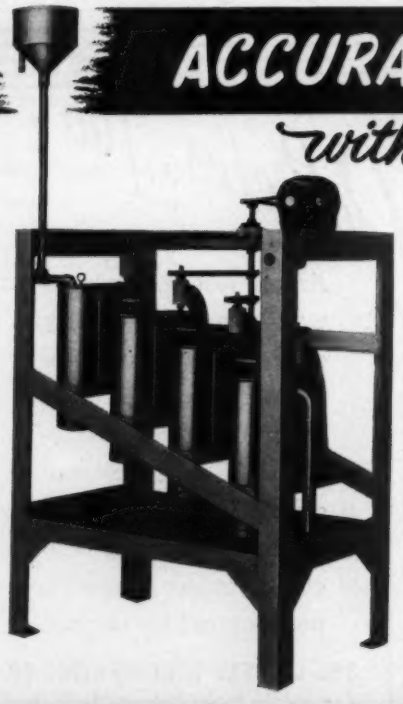

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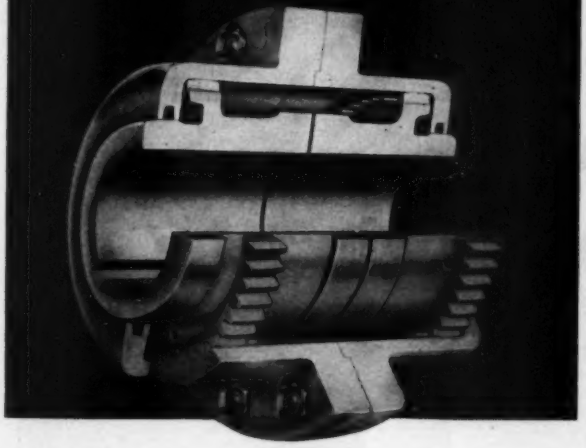

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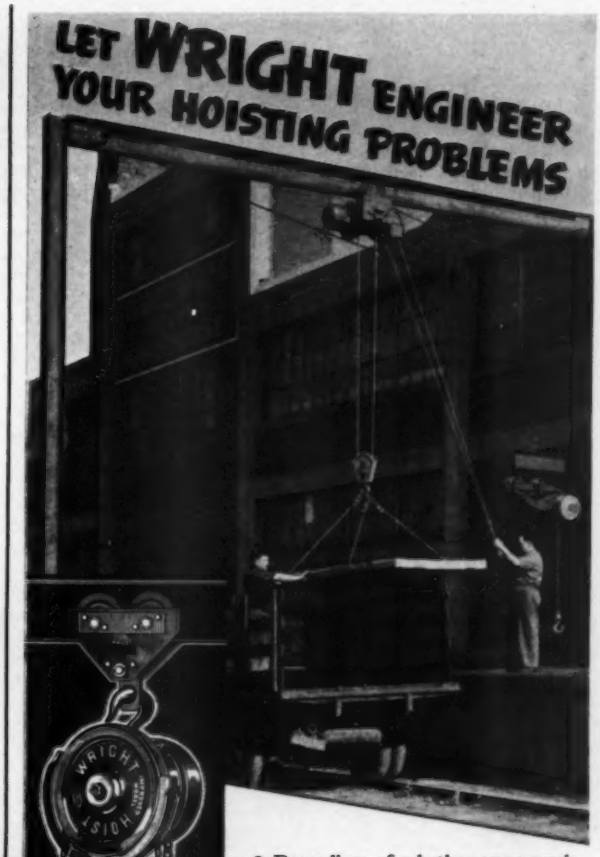

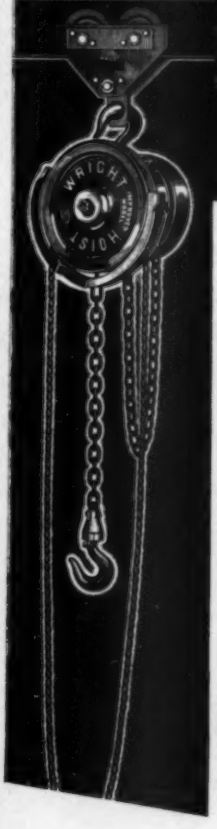


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in the lignin cause absorption of alkali at the interface. The amount of alkali present is contingent on the ratio of the molarity of the solution to the saturated solubility of the base—this being known as the "escaping tendency" of the solution. This will vary with the solvent used, and simple alcohols were employed as solvents for the alkali. (2) Chemical combination takes place between lignin and alkali. (3) A chemical hydrolysis permits one alkali lignin complex to leave the lignin surface and to enter solution in the liquor. The energy to insure solution of the one alkali-lignin complex has been calculated as approximately $5.3 \times 10^{-30}$ calories. Illustration shows the rate of delignification with 2.0 molar NaOH at 160 deg. C., showing the linear relationship between time and residual lignin in alkali treated wood, the change at about 2% residual lignin, and the fact that wood density has no great effect on delignification rates. This is an extremely important contribution. G. L. Larocque and O. Maass. Canadian J. Research 19B, 1-16 (1941).

## Significance of Fiber Bonding Substances in Pulping

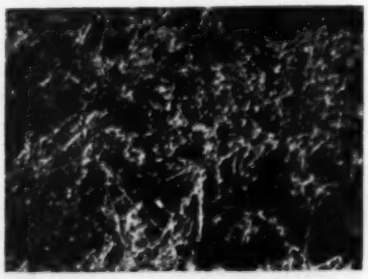
The authors claim that besides lignin, another non-lignin bonding material must be removed from wood before the fibers can be separated from each other. Delignified sections of wood, warmed for 15 minutes at 50 deg. with 0.08% NaOH yielded 67% of free fibers (the wood used is not given in the abstract). When there was a pretreatment of the sections with dilute boiling aqueous NaOH, 69% of the "free fibers" were isolated after delignification. Evidently then this bonding material may be either removed or modified prior to the actual pulping. The authors discuss the site of the bonding material in the cell wall. In the case of one species of eucalyptus, the holocellulose when extracted successively with dioxane, water and very dilute aqueous NaOH gave 2.8% of a non-furfural yielding material, which may be the fiber-bonding (non-lignin) substance above-mentioned. H. E. Dadswell and Dorothie J. Ellis. J. Council Sci. Ind. Research 13,290-8. A. W. Mackney. *Ibid.* 13, 299-304 (1940) through C.A. 35, 1631 (1941).

## Bamboo Pulps

Bamboo in Taiwan was the material studied. Light colored pulps were obtained by the use of magnesium and calcium bisulphites. Unbleached pulp still retained 3.3% lignin, and 14.66% pentosans. The ash content was 0.81%; the Sieber value about 41. Since the ash of bamboo *(Phyllostachys bambusoides)* retains largely sodium and potassium compounds, acid digestions (such as the use of nitric acid) are preferable for producing pulps low in ash. On the other hand to remove more of the pentosans, alkaline digestions are preferable. Apparently the nitric acid method gave the best results with bamboo. Minoru Tutiya and Setuo Hukuhara. J. Agr. Chem. Soc. Japan 16, 621-5 (1940) through C.A. 35, 1989 (1941).

## Groundwood from beech

Experiments indicate that up to a 50-50 mixture of spruce and beech groundwood, sheets may be obtained which are quite satisfactory in their physical properties. Such mixtures can be used in pasteboard manufacture. Beech wood is much more readily ground than is spruce, and power and steam consumption are both low. A great disadvantage was however the formation of a foam in beech grinding that caused great losses. This seems to have been overcome by the addition of oleic acid, although this and other foam removers are too costly. Recently a German patent suggests the use of lignite which appears to be practical and which should insure the utilization of beech groundwood. Strength tests on sheets made from various mixtures of beech and spruce are given. The illustration below shows a photo-micrograph of a 50-50 mixture of spruce and beech mechanical pulp. Fritz Benninger. Wochbl. Papierfabr. 72, 118-20 (1941).

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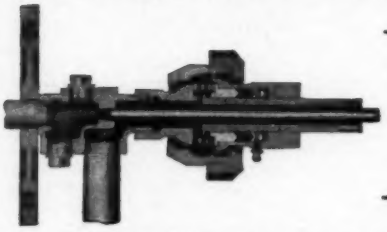

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# PAPERMAKING PATENTS

IN THE UNITED STATES—Compiled by James Atkins, Registered Patent Attorney

Inquiries should be addressed to James Atkins, Munsey Building, Washington, D. C.

## Process for Removal of Dirt from Pulp

Patent No. 2,207,218. Loren V. Forman, Munising, Mich., assignor of one-half to The Munising Paper Company, Munising, Mich., a corporation of Ohio. Application August 6, 1937, Serial No. 157,767. 1 Claim. (Cl. 92—28). The process of separating dirt from wood pulp in a water suspension, which comprises diluting the stock to a consistency of .02% to .25% flowing said suspension in a horizontal plane across a settling chamber, allowing the dirt and heavy stock to settle, introducing a rising current of water at different depths in the settling chamber, thereby progressively sorting said dirt from the fibers by moving the fibers upwardly while the dirt settles, and introducing water tangentially to the settling chamber above the point at which said water enters the settling chamber, whereby the settling material is treated to a uniformly rising current of water to remove any remaining fibers from the dirt.

## Method of Saturating Fibrous Stock

Patent No. 2,218,547. Izador J. Novak, Trumbull, Conn., assignor to Raybestos-Manhattan, Inc., Bridgeport, Conn., a corporation of New Jersey. Application March 29, 1937, Serial No. 133,573. Renewed November 27, 1939. 10 Claims. (Cl. 92—41). A process of adding a modifying agent in a liquid vehicle to a wet fibrous web, which comprises moving the wet web into contact with a foraminated roll, rotating said roll about a substantially horizontal axis in a body of said liquid for immersing said web therein, maintaining the level of liquid in the interior of the roll at a level lower than the level at the exterior of the roll, whereby the wet web is caused to adhere to the surface of the roll solely by the differential in pressures of the liquid levels as it passes through the body of liquid, compressing the treated web against the roll after immersion, and stripping the web from the roll.

## Coating Evening Means for Paper Laminating Machines

Patent No. 2,221,441. George W. Charters, Camas, Wash. Application January 15, 1940, Serial No. 313,897. 5 Claims. (Cl. 91—33). In a laminating machine having devices for moving and guiding the sheet to be treated, and means for applying a coating to one side of the sheet, a device for evening the application of the coating comprising, a horizontally-supported bar, the top of which is provided with two longitudinally-extending knife-edges spaced apart by a relatively narrow vertical groove of substantial depth, an evening rod of slightly greater diameter than the width of said groove and supported on said knife-edges, the end of the sheet on leaving said coating means passing over said evening rod, and means for rotating said rod in the direction opposite to the travel of the sheet.

## Pulp Bleaching Apparatus

Patent No. 2,198,709. George H. Tomlinson, Westmount, Quebec, Canada. Application October 30, 1937, Serial No. 171,889. In Canada October 7, 1937. 4 Claims. (Cl. 68—27). Pulp bleaching apparatus comprising a mixing device to which pulp and bleaching liquor are supplied, a tall downflow bleaching tower to which the mixture of pulp and bleaching liquor is fed from said mixing device, said mixture being introduced into the top of said tower, a tall upflow tower means for continuously transferring the pulp stock from the bottom of the downflow tower to the bottom of the upflow tower so that the pulp rises in said upflow tower to produce an overflow equivalent to the amount of pulp entering the downflow tower, each of said towers being provided with an internal partition affording a substantially horseshoe-shaped open top circulating channel in the bottom portion of the tower, said partition comprising a vertical wall extending from one side of the tower partly across the bottom wall to a point spaced from the opposite side, and an external circulating circuit connected to the ends of the circulating channel of each tower so that a portion of the pulp is continuously withdrawn from the bottom of the tower at one end of the channel and returned to the bottom of the tower at the opposite end of the channel to keep the pulp thoroughly mixed and to prevent short circuiting or channelling of the pulp in its passage through the towers.

## Treatment of Woody Material

Patent No. 2,228,349. Soldon Feldman, East Alton, Ill., and Fredrich Olsen, St. Louis, Mo., assignors to The Cellulose Research Corporation, East Alton, Ill., a corporation of Delaware. Application November 28, 1936, Serial No. 113,124. 5 Claims. (Cl. 92—13). A process for the delignification of wood comprising treating the wood in the form of small pieces with a heated water solution of a non-delignifying salt forming an electrolyte in the solution of a concentration low enough to be just sufficient to deposit by adsorption on the surfaces of the capillaries and membranes ions in layer formation providing protective coatings on said surfaces and facilitating the passage of an alkaline delignifying agent to the interiors of the wood pieces, subjecting said wood pieces to said electrolyte solution under time and temperature conditions effecting said adsorption of ions from the electrolyte on the interior surfaces of the wood while avoiding delignification and maintaining the accessibility of the membranes and capillaries, then subjecting said wood pieces so impregnated with an electrolyte to soaking in an alkaline digesting liquor at a temperature below the digestion point and for a time sufficiently long to effect a complete impregnation of the wood pieces with the liquor, and then raising the temperature to digest the wood.

## Apparatus for Vibrating Paper Making Machines

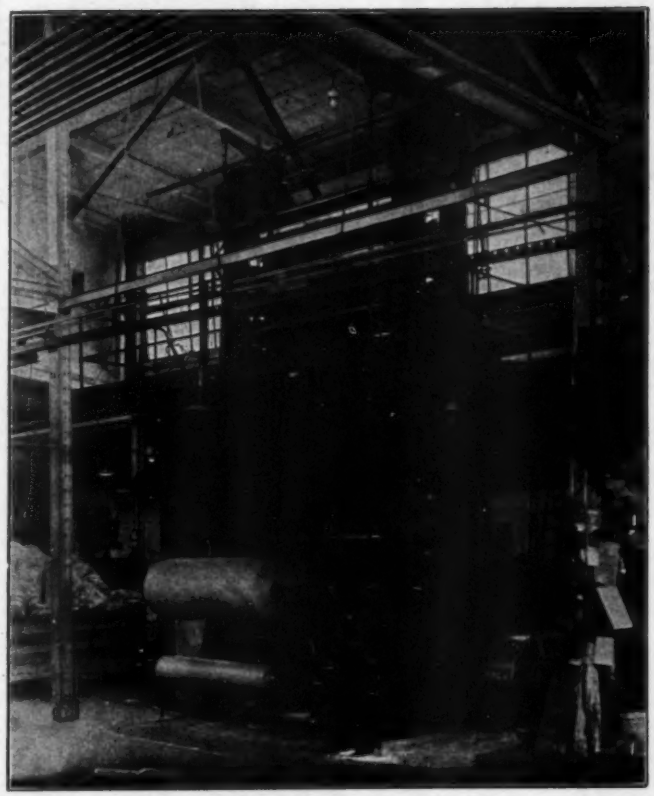
Patent No. 2,202,032. Edward W. Smith, Melrose, Mass., assignor to Submarine Signal Company, Boston, Mass., a corporation of Maine. Application May 20, 1938, Serial No. 209,037. 10 Claims. (Cl. 92—45). A Fourdrinier paper machine having a shake section containing a pair of shake rails pivoted at one end, means for vibrating said section comprising a plurality of separate, independently vibratable mass elements each individually coupled through elastic elements to one of said shake rails at different points, one of said masses being coupled to the shake rail at the center of percussion of the machine, the remaining mass elements being coupled to the shake rail between the center of percussion and the breast roll end of the machine, the several masses and their elastic elements being proportioned to produce with the machine a vibratory system resonant at the desired shake frequency.

## Wax Paper Sheet and Coating Therefor

Patent No. 2,227,516. Randolph Spencer Soanes, Toronto, Ontario, Canada, assignor to Appleford Paper Products, Ltd., Hamilton, Ontario, Canada. Application July 11, 1938, Serial No. 218,637. 2 Claims. (Cl. 91—68). A paper sheet provided with a flexible opaque moisture resistant heat sealable surface coating characterized as applied to the sheet as a hot melt coating comprising a molten solution of paraffin wax and rubber carrying sufficient titanium dioxide in suspension to opacify the coating, the relative density of the molten paraffin wax and titanium dioxide being such that the titanium dioxide would not remain in suspension in the molten paraffin alone, the amount of rubber being sufficient to retain the titanium dioxide in suspension in the molten wax and being within the range of one part of rubber to 3 to 7 parts of titanium dioxide in the solution, the sum total of titanium dioxide and rubber not exceeding 20 per cent of the paraffin wax.

## Paper Coating Material and the Paper Coated Therewith

Patent No. 2,231,902. James S. Offutt, Evanston, and Joseph W. Gill, Elmhurst, Ill., assignors to United States Gypsum Company, Chicago, Ill., a corporation of Illinois. Application March 2, 1939, Serial No. 259,386. 10 Claims. (Cl. 134—20). A paper coating mixture comprising casein, a casein solvent, formaldehyde, clay, "gamma gypsum," and water.



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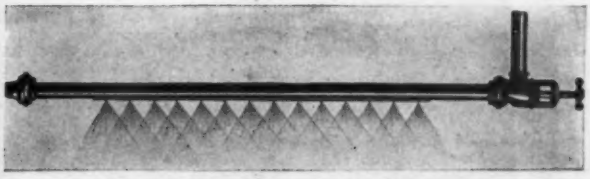

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**More washing with less water and pressure — cleans felts and wires with less power for water pump.**

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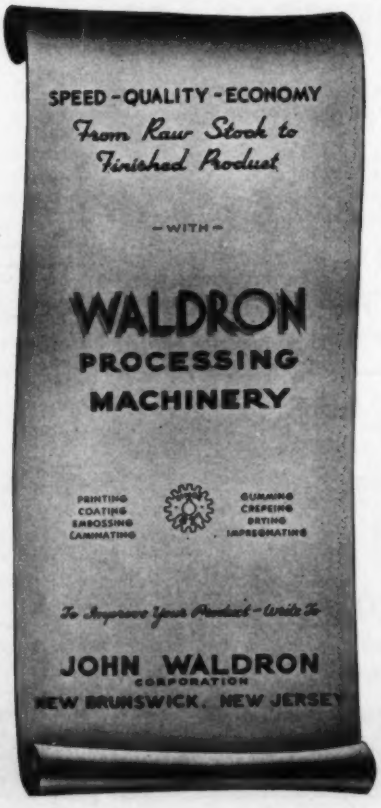
# New Catalogues, Ass'n Reports, and Publications

**Aetna Ball Bearing Mfg. Co.,** Chicago —A new publication recently published by this company entitled "Bearings" gives all the features of the ball and roller bearings that are manufactured by them. Also the production processes and inspection carried out in the factory are shown with illustrations. Charts and graphs are used throughout the publication to show the functions of the various types of bearings.

**Allis-Chalmers Mfg. Co.,** Milwaukee, Wis.—This company has just issued a new comprehensive, 40-page bulletin (No. B-6146) for every pumping service requiring a high grade single-stage double suction centrifugal pump. In addition to constructive features, pump dimensions, normal and special application data, this profusely illustrated bulletin presents friction tables, head-capacity tables, and other valuable pump engineering information.

**American Machine and Metals, Inc.,** East Moline, Ill.—A new booklet, written in non-technical language, on the subject of sound levels and other related factors governing selection of axial flow fan units has just been published by this company. Some of the subjects that are discussed are; methods of rating noise levels in decibels, comparison of various sound reference levels, influence of fan tip speeds and effect of distance on noise readings. Charts and diagrams are used throughout the booklet.

**American Schaffer & Budenberg Instrument Division,** Bridgeport, Conn.—An exceptionally well-arranged, 82 page catalogue (No. 2500) on the various types of temperature and pressure controllers that are manufactured by this company has just been released. Each one of the controllers is discussed thoroughly and the descriptive material is supplemented by pictures, charts, and graphs giving a clear picture of the functions and capacities of each one. This publication would be a valuable aid in the selection of any type of controller.



**Bauer Brothers Co.,** Springfield, Ohio —This company has just released a new pamphlet type publication on the Bauer double revolving disc Pulper No. 137—24". This publication gives a complete description of this machine together with information on the principle of operation, its applications, the details of construction, the feeding, the motors, and dimensions of the parts of the machine.

**Bender Warrick Corp.,** Birmingham, Mich.—A 23-page catalog (No. 241) on floatless controls has recently been issued. The illustrations show many of the controls made by this company, together with accessory parts and also line diagrams giving dimensions and instructions in wiring. Prices and specifications for the various size controls are arranged in chart form.

**Blackhawk Manufacturing Co.,** Milwaukee, Wis.—This company recently issued a new 40-page catalogue featuring many 1941 developments in socket, box-type, tension, and specialty wrenches for use in industrial, construction, and aviation work. Blackhawk claims a number of exclusive features in this progress and points out that this general improvement is especially important in defense work because time-taking and expensive "home-manufacture" of many special wrenches is made unnecessary.

**Brown Instrument Co.,** Philadelphia.—A new and well-presented publication in the form of a calendar has recently been published by this company. Many of the problems in the industrial processes are presented in a humorous vein by a series of cartoons. There is also included in the publication engineering information in the form of charts for fuel gas analysis, steam leakage, psychrometric, pipe data, comparative fuel costs, oil measurement table at 60 deg. Fahr., etc. All the control systems for indicating, recording, controlling, and signaling produced by this company are listed together with information concerning the functions of each.

Another booklet entitled "Brown Non-Indicating Air Operated Controllers" (No. 77-2) has just been issued by this company. The booklet describes the non-indicating temperature controller, giving a complete description of the instrument and suggested applications. Large, clear pictures illustrate the important operating features, constructional features and exterior views of the instrument. Also included are diagrams showing a typical application, an actual installation photograph, and drilling and mounting dimensions.

**Burrell Technical Supply Co.,** Pittsburgh, Pa.—This company recently published a catalogue (No. F-241) treating the subject of high temperature furnaces. The various furnaces dealt with are the box type furnace, the muffle type furnace, the pit furnace, and tube type furnace. Also many of the accessories such as, automatic controls, high temperature combustion tubes, furnace pyrometers, tap transformers, etc. are discussed. Illustrations and charts are used extensively throughout the booklet.

**Cameron Machine Co.,** Brooklyn, N. Y. —A folder type publication has just been issued by this company describing the Camachine 20 manufactured by this company which is used as a winder in newsprint, book, and kraft paper. Many of the advantages of this machine are listed and the principle of operation is described with the use of illustrations. Specifications are listed with diagrams.

**Elgin Softener Corp.,** Elgin, Ill.—A new bulletin (No. 605) has just been released by this company. It describes the company's line of Double Check Zeolite Water Softeners. It also contains a complete, easily understood description of the principle of the softener, and shows how these new softeners offer 25 per cent more efficiency than the conventional softener of equal size. Enlarged close-up views of the various parts are used to display the machine.

**Elliott Service Co.,** New York, N. Y. —This company has just issued a comprehensive and timely booklet on the subject of training new and prospective foremen. Because of the shortage of competent foremen qualified to direct expanding work forces, the information contained in this publication is in demand. The need for a training plan is explained and the plan itself is discussed in detail, with suggestions for various texts to be used in carrying out the course of study.

**Fairbanks-Morse & Co.,** Chicago—This company has just published a new bulletin (No. 5410SS) dealing with the sump and bilge pumps manufactured by this company. Large illustrations are used to show the outstanding features and the details of construction in the pumps. Comprehensive charts are included to be used as pump selection tables. One entire section of the booklet is devoted to the typical specifications for pumping equipment that are used by engineers and architects.

**General Blower Co.,** Chicago—A comprehensive catalogue discussing fans, blowers, exhausters, and ventilators, with engineering data, has been issued by this company. Careful treatment is given to each individual piece of machinery, explaining its function and using charts, illustrations, and diagrams to give a clear understanding. This publication contains much that would be of assistance to anyone interested in this company's equipment.

**General Printing Ink Corp.,** New York, N. Y. — Two booklets dealing with the subject of "Color" have just been sent out by this company. The first, entitled "The Psychology of Color" deals with the underlying or psychological effects brought about by the various colors and the second, entitled "The Symbolism of Color" discusses the specific symbols of each color. Each color is treated individually together with information about the early historical beliefs and influences.

**Graham Transmissions, Inc.,** Milwaukee, Wis.—A bulletin (No. 501) which can be used as a technical guide for engineers who design and specify machinery has just been issued by this company. This new publication deals specifically with the subject of "When to Use the Graham for the Variable Speed Control" and includes an outline of the laws of metallic traction. Illustrations, diagrams, and charts are used to give a clear picture of the functions and advantages of this speed drive. Specifications, in chart form, are also included.

**Heresite & Chemical Co.,** Manitowoc, Wis.—A very informative booklet on the subject of finishes and plastics and how they are used to solve corrosion problems has been published by this company. Illustrations demonstrate a few of the many uses of Heresite. Other applications are listed and explained in detail. Charts are included which show the results obtained from tests, made on the effects that various acids had on products protected by Heresite coating.

**Jewell Belt Hook Co.,** Naugatuck, Conn.—The special features employed in the manufacture of Jewell Potter Belt Hook, manufactured exclusively by this company, and distributed by them for

# SIMONDS

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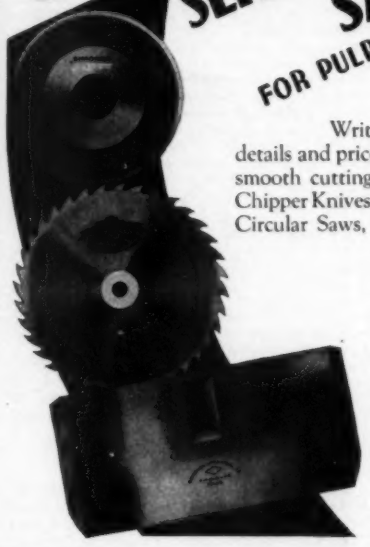
FOR PULP *and* PAPER MILLS



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This fixed-speed dough mixer was transformed into a flexible, smooth-performing, highly-efficient machine. Now, any speed is available and speeds are changed quickly while mixing continues.

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*Variable Speed* { TRANSMISSIONS MOTOR PULLEYS

★ Lewellen knows speed control

over fifty years, are outlined in a booklet which will be sent to anyone interested. Illustrations show each step in the splicing of belt by use of the Potter Hooks. A price list of hooks for leather, rubber, or fabric belts is also given.

**Johns-Manville Corp.**, New York, N. Y. —A new publication entitled "Use of Celite in the Production of Paper" has just been published by this company. Pitch control is one of the subjects discussed in the set of illistrated data sheets contained in this publication. Also covered are the effects of Celite in increasing bulk and ink absorption as well as affording better brightness and opacity at lower cost. There are described in the data sheets the properties of Celite 340, (G. E. brightness-95), a newly developed grade of lightweight filler, through the use of which the above desirable paper characteristics can be attained. Celite 305, a special grade for sheets of lower brightness, is also described.

**Lyon Iron Works**, Greene, N. Y. — A new circular (No. 120) briefly describing the various material handling equipment, most of which is hydraulic, has recently been published by this company. Illustrations are used to give a clear concept of the machinery and it is also thoroughly explained as to uses, specifications, design, and advantages. This circular can be obtained from the Lyon Iron Works, 663 Madison street, Greene, New York.

**National Oil Products Co.**, Harrison, N. J.—This booklet recently published by this company is entitled "The NOPCO Method of Pitch Control" and reviews the various methods being used to eliminate the pitch hazard. Special sections of the booklet are devoted to the emulsification of pitch and the "NOPCO Method." The success of this method is attributed to an especially developed emulsifying and dispersing agent, trade-named NOPCO 1216-V. Other sections outline step-by-step procedures to be followed to obtain best results with this method, with application of the process to paper mills, tissue mills, and pulp mills.

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**Oliver United Filters, Inc.**, New York, N. Y.—A new publication has been issued by this company listing some of the latest installations of the Oliver board forming machine and using large illustration picturing the machine after the installation. A section of the booklet is devoted to the treament of the advantages of the latest developments in the new board machine manufactured by this company. Information concerning the construction of the machine is also included.

**Revere Electric Mfg. Co.**, Chicago—A new 100-page catalogue (H) has just been published by this company. It lists a complete line of service station lighting equipment together with floodlight units and poles covering industrial and sports lighting requirements. A few of the subjects that are dealt with are fluorescent lighting, high mounting flood lights, pit lights, portable light and tool carts, and recreational field lighting. Helpful information is supplied for the proper selection of units together with illustrations.

**Roots-Connersville Blower Corp.**, Connersville, Ind.—This company has just issued an eight-page, two-color folder (Bulletin G-70) which covers briefly the applications of this company's complete line of products. The folder is profusely illustrated with installation views, but text matter has been minimized. Separate pages are devoted to positive displacement blowers, positive exhausters and boosters, rotary displacement meters, liquid and vacuum pumps, etc.

**R-S Products Corp.**, Wayne Junction, Philadelphia—A new and well-presented, 12 page bulletin (8-B) featuring late models of standard and wafer type butterfly or blast gate valves for the control of air, gas, steam, and liquids has been published by this corporation. This booklet also contains interesting data and illustrations for both manual and automatic control by means of air and electric motors, solenoids, air, and hydraulic cylinders. Complete specification and flow charts are also included.

**Sarco Co., Inc.**, Chicago—A bulletin (No. 475) treating the subject of a draining system for paper machine drying cylinders has been issued by this company. The pamphlet discusses the rapid and complete removal of air, the the ease of installation, the advantages of the machine, and the recovery of flash steam together with illustrations and diagrams of the machine and many of its parts.

**Worthington Pump and Machinery Corp.**, Harrison, N. J.—This company has recently published three new pamphlets. The first (Bulletin W-325-B1) deals with Condensate pumps for condensate, chilled water, and general service. The second is concerned with steam-jet ejectors of the single-stage and the third is also on steam ejectors but of the two-stage design. Complete specifications are included in all three of the publications.

## Association Reports

**The Pulp and Paper Industry and National Defense**—A report issued by the Advisory Committee for the Pulp and Paper Industry to the Council of National Defense, E. W. Tinker, Secretary. This report outlines several definite steps taken by the American Paper and Pulp Association in its contacts with the Industrial Materials Division of the National Defense Advisory Commission. The Advisory Committee's report is published *in toto*, and the four major factors involved in pulp and paper supplies and requirements are treated: (1) Pulpwood; (2) Wood Pulp; (3) Waste Materials; (4) Paper and Paperboard. Accompanying data in tabular form gives the productive capacity of the paper industry in the United States, under various grades. The probable minimum and estimated maximum U. S. wood pulp requirements are also shown in tabular form. The Committee's conclusions and recommended program are given, and the report shows an adequate surplus of installed capacity over and above the requirements estimated by the Government.

**Representative Union Agreements in the Paper and Pulp Industry**—This bound report of 48 pages and cover, is issued by the American Paper and Pulp Association to further amicable labor relations among member mills. The report begins with the text of an agreement which is basically an extension of the original agreement in effect continuously, with amendments, since August 1, 1934, between the two International Brotherhoods and most of the pulp and paper manufacturers of the Pacific Coast. Four types of agreements which certain companies have negotiated with their labor unions are included. In his release accompanying this report, E. W. Tinker, secretary of the Association, states that "It should be emphasized that individual company problems require individual attention and that, therefore, every agreement must, by the very nature of things be custom-made. . . . The attached agreements, therefore, are in no sense intended as models. They are reproduced without reference to their merits or faults, and are presented with the thought that they may be of value as representative specimens to companies engaged in labor negotiations."

## Books

**Lactolin as a Glycerol Substitute**—This work is a mimeographed translation of an article by E. Belani that was published in Wochenblatt für Paperfabrikation [71,375-8 (1940)]. This translation is the work of Hooker Scientific Library, Central College, Fayette, Missouri. Obtainable through the Library, the translation is priced at 85 cents a copy.

**Fiber Leather Substitutes** — Hooker Scientific Library, Central College, Fayette, Missouri, has issued a translation of an article on this subject by Fritz Hoyer, the original appearing in Wochenblatt für Papierfabrikation [71,459-61 (1940)]. The translation, available in mimeographed form from the Library, is priced at 65 cents a copy.

**How to Teach a Job**—R. D. Bundy, the author of this Manual, is Industrial Coordinator of the Board of Education of the city of Cleveland. Out of actual experience, he sets forth in this book an organized plan for teaching new workers specific jobs. The purpose of the manual is to outline the steps in teaching and to point out certain procedures which are involved, as well as certain precautions which bear directly upon the success of teaching a job. It is a 60-page book, attractively bound in blue cloth cover. Published by The National Foremen's Institute, Deep River, Conn., the book is priced at $1 a copy.

**Photo-Offset Lithography**—This book is the work of Donald Nicholson, Manager, Ronalds Offset Lithographers Limited, Montreal, Canada. Although written particularly for appentices and those in the lithographic trade who do not have a scientific background, it should be of interest to paper technologists, paper mill production executives and others in the papermaking industry who might be interested in learning some of the fundamentals of photo-lithography. The book contains five chapters: namely, Preparation of Copy; Camera Work; Layout; Plate Making; and Press Work. It is a volume of more than 150 pages, durably bound in blue cloth cover with backbone printing in gold. The price of the book is $3.50 a copy; the publisher, Chemical Publishing Co., Inc., 148 Lafayette St., New York, N. Y.

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2—1196 HP Stirling boilers, 250-lb. pressure.
1—1000 HP Stirling boiler, 275-lb. pressure.
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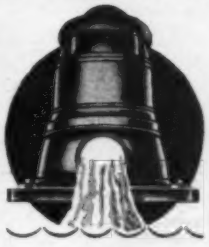
# IF YOU ARE "ON THE SPOT" FOR MORE WATER



In these days of high speed production, you cannot afford water shortage. For men, machines, materials—and fire protection, you must have an abundance of water at all times. In the scene above, some 25,000,000 gallons of water daily are being produced from Layne Wells and Pumps for an important industry. Your needs may not be so great—or they may far exceed that amount. In any event Layne—the world's largest water producers—can, with speed and efficiency fulfill your needs. Layne has both the man power and equipment to speedily complete well water systems of any size.

Layne Wells and Pumps are world famous for high efficiency, long life and low upkeep expense. They are designed to stand twenty-four hour heavy duty operation. And furthermore they will pay dividends in savings over water purchased from outside sources.

Layne Well Water Systems are built to serve the requirements of cities, towns, factories, railroads, chemical plants, paper mills, hotels, department stores, breweries, refineries, mines and irrigation projects. Your engineer knows of no other well water system that ranks so high in efficiency—none that produces big volumes of water at such low cost. For literature, address

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LAYNE-NORTHERN CO., MISHAWAKA, IND.
LAYNE-LOUISIANA CO. LAKE CHARLES, LA.
LAYNE-NEW YORK CO. . NEW YORK CITY, AND PITTSBURGH . . . . . PA.
LAYNE-NORTHWEST CO. MILWAUKEE, WIS.
LAYNE-OHIO CO. . . . COLUMBUS, OHIO
LAYNE-TEXAS CO. . . . HOUSTON AND DALLAS . . . . . TEXAS.
LAYNE-WESTERN CO., KANSAS CITY, MO. CHICAGO, ILL. . . . OMAHA, NEBRASKA
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# CURRENT MARKET QUOTATIONS

## RAGS (Domestic)
*f. o. b. New York City*

| NEW RAGS | per cwt. |
|---|---|
| Blue Overalls | 4.25 to 4.50 |
| Corduroy | 2.25 to 2.50 |
| **Cottons—** | |
| Washables, No. 1 | 2.00 to 2.25 |
| Fancy Percales | 3.50 to 3.75 |
| New Soft Blacks | 3.25 to 3.50 |
| New Light Seconds | 1.75 to 1.85 |
| New Dark Seconds | 1.50 to 1.65 |
| **Khaki Cuttings—** | |
| Mixed | 2.50 to 2.75 |
| O. D. | 3.00 to 3.25 |
| New White Canvas | 7.00 to 7.50 |
| New Mixed Blacks | 2.25 to 2.50 |
| **Shirt Cuttings** | |
| New White No. 1 | 6.00 to 6.25 |
| Silesias No. 1 | 4.25 to 4.50 |
| New Unbleached | 6.00 to 6.25 |
| Fancy | 2.15 to 2.35 |
| **Linen Cuttings—** | |
| White | 12.00 to 12.50 |
| Grey | 11.50 to 12.00 |

## RAGS (Domestic)
*f. o. b. New York City*

| OLD RAGS | per cwt. |
|---|---|
| **Roofing—** | |
| No. 1 | 1.30 to 1.35 |
| No. 2 | 1.00 to 1.10 |
| No. 3 | .90 to 1.00 |
| **Twos and Blues—** | |
| Repacked | 1.60 to 1.75 |
| **Thirds and Blues—** | |
| Repacked | 1.35 to 1.50 |
| Miscellaneous | 1.15 to 1.25 |
| **White, No. 1—** | |
| Repacked | 3.00 to 3.50 |
| Miscellaneous | 2.50 to 2.75 |
| **White, No. 2—** | |
| Repacked | 2.50 to 2.75 |
| Miscellaneous | 2.00 to 2.25 |

## RAGS (Foreign)
*ex dock New York City*

| NEW RAGS | per cwt. |
|---|---|
| New Dark Cuttings | Nominal |
| New Mixed Cuttings | |
| New Light Silesias | |
| Light Flannelettes | |
| Unbleached Cuttings | |
| New White Cuttings | |
| New Light Oxfords | |
| New Light Prints | |

## RAGS (Foreign)
*ex dock New York City*

| OLD RAGS | per cwt. |
|---|---|
| No. 1 White Linens | Nominal |
| No. 2 White Linens | |
| No. 3 White Linens | |
| No. 4 White Linens | |
| No. 1 White Cottons | |
| No. 2 White Cottons | |
| No. 3 White Cottons | |
| No. 4 White Cottons | |
| Extra Light Prints | |
| Ord. Light Prints | |
| Med. Light Prints | |
| Dutch Blue Cottons | |
| French Blue Cottons | |
| French Blue Linens | |
| Checks and Blues | |
| Linsey Garments | |
| Dark Cottons | |
| Old Shapperies | |

## ROPE and BAGGING
*f. o. b. and ex dock New York City*

| | per cwt. |
|---|---|
| Gunny No. 1— | |
| Foreign (Nom.) | 3.50 to 3.75 |
| Domestic | 3.50 to 3.75 |
| Wool Tares— | |
| Light | 3.25 to 3.50 |
| Heavy | 3.40 to 3.60 |
| No. 1 Scrap Bagging | 3.15 to 3.40 |
| Manila Rope— | |
| Foreign | 5.50 to 6.00 |
| Domestic | 5.50 to 5.75 |
| New Burlap Cuttings | 4.25 to 4.50 |
| Jute Threads— | |
| Foreign (Nom.) | 5.25 to 5.50 |
| Domestic | 4.25 to 4.50 |
| Strings— | |
| Sisal | 2.75 to 3.00 |
| Soft jute | 3.50 to 3.75 |
| Mixed | 1.20 to 1.40 |

## WASTE PAPER
*f. o. b. New York City*

| | per cwt. |
|---|---|
| Shavings— | |
| White Envp. Cuttings | 3.25 to 3.40 |
| Ord. Hard White No. 1 | 2.50 to 2.75 |
| Ord. Soft White No. 1 | 2.20 to 2.40 |
| Soft White, Extra | 2.65 to 2.85 |
| Flat Stock— | |
| Stitchless | 1.10 to 1.20 |
| Overissue Mags. | .95 to 1.05 |
| Solid Flat Book | .85 to .95 |
| Crumpled No. 1 | .75 to .85 |
| Solid Ledger Books | 2.00 to 2.10 |
| Ledger Stock— | |
| White | 1.65 to 1.75 |
| Colored | 1.15 to 1.25 |
| New B. B. Chips | .45 to .55 |
| Manilas— | |
| New Env. Cuts | 2.65 to 2.85 |
| New Cuttings | 1.85 to 2.00 |
| Sulphite Mill Wrappers | .50 to .60 |
| No. 1 Old Kraft | 1.25 to 1.40 |
| News— | |
| No. 1 Wh. News Cuttings | 1.55 to 1.65 |
| Strictly Overissue | .75 to .85 |
| Strictly Folded | .60 to .70 |
| No. 1 Mixed Paper | .40 to .50 |

## CHEMICALS
*f. o. b. shipping point*

| | |
|---|---|
| Alum (Papermakers)— | |
| Lump, cwt. | 3.75- |
| Ground, cwt. | 3.50- |
| Powdered, cwt. | 3.90- |
| Blanc Fixe— | |
| Pulp, bulk, ton | 35.00 to 42.00 |
| Dry, barrels, pound | .0300 to .0400 |
| Bleaching Powder— | |
| Drums, cwt. | 2.00 to 3.00 |
| Casein (Domestic Standard)— | |
| 20-30 mesh (bags), lb. | 14.00 to 15.00 |
| 80-100 mesh (bags), lb. | 15.00 to 16.00 |
| Argentine, lb. | 14.00 to 14.50 |
| China Clay— | |
| Domestic Filler | |
| Bulk (mine) ton | 7.50 to 15.00 |
| Domestic Coating | |
| Bulk (mine) ton | 12.00 to 22.00 |
| Imported (ship side) | |
| Bulk (lump) ton | 15.00 to 26.00 |
| Chlorine— | |
| Tank cars (wks) cwt. | 1.75 to 1.90 |
| Gelatine (silicin), lb. | .70 to .75 |
| Glyc. (C.P.) drums, lb. | .1250 to .1300 |
| Litharge, powd., bbl., lb. | .08¼ to |
| Rosin (Gum)— | |
| New York, per 100 lbs. | |
| R. | 2.40- |
| F. | 2.42- |
| G. | 2.43- |
| WW. | 3.25- |
| Rosin (Wood), carlots | 1.54- |
| Salt Cake— | |
| Dom. bulk (wks) ton | 16.00 to 17.00 |
| Imp. bulks on dock— | |
| (Atl. ports) ton (Nom.) | 20.00 to |
| Soda Ash— | |
| Bulk (works), cwt. | .90 to .95 |
| Paper Bags, cwt. | 1.05 to 1.35 |
| Barrels, cwt. | 1.05 to 1.35 |
| Soda (Caustic)—Ammonia, | |
| Solid, drums, cwt. | 2.30 - |
| Ground and flake, drums, cwt. | 2.70 - |
| Sodium Silicate— | |
| 60 deg., 55 gal. drums, (works) cwt. | 1.65 to 2.00 |
| 40 deg., 35 gal. drums, (works) cwt. | .80 to 1.45 |
| Starch— | |
| Pearl, 140 lb. bags, cwt. | 2.95- |
| Pearl, barrels, cwt. | 3.05- |
| Paper (Sp.) bags, cwt. | 3.05- |
| barrels, cwt. | 3.15- |
| Sulphur (crude)— | |
| (mine) bulk, long ton | 16.00 to 20.50 |
| Talc— | |
| Dom. 100 lb. bags (mine) ton | 15.00 to 20.00 |
| Imp. bulk, ton (Nom.) | — |
| Titanium Dioxide— | |
| Barium Pig., bbls., lb. | .05¾ to .05¾ |
| Calcium Pig., bbls., lb. | .05 to .05¾ |
| Zinc Sulphide, bbls., lb. | .07¾ to .08 |

## CHEMICAL PULP
*(Air-dry ton)*

| | per cwt. |
|---|---|
| Soda (Dom.) del'd. mill— | |
| Bleached, contract | 3.20 - |
| Open market | 3.30 - |
| Sulphate (Dom.) f. o. b. mill— | |
| Bleached | 4.00 to 4.25 |
| Kraft No. 1 | 3.25 to 3.50 |
| Kraft, Southern, del. | 3.00 to 3.25 |
| Sulphate (Imp.) on dock— | |
| Bleached | 4.50 to 4.75 |
| Kraft No. 1 | 3.50 to 3.75 |
| Kraft No. 2 | 3.25 to 3.50 |
| Sulphite (For.) | |
| On dock— | |
| Prime bleached | 4.00 to 4.25 |
| Prime easy bleach | 3.75 to 4.00 |
| Prime strong unbl. | 3.25 to 3.50 |
| Sulphite (Dom.) | |
| Bleached, contract | 3.62½ - |
| Bleached, open market | 3.62½ - |
| Unbleached, contract | 3.17½ - |
| Unbleached, open market | 3.17½ - |

## MECHANICAL PULP
*(Air-dry ton)*

| | per ton |
|---|---|
| No. 1 Dom. & Can. (f. o. b. pulp mill) | 30.00 to 33.00 |
| No. 1 Imp. (On dock)— | |
| Moist | — |
| Dry | — |

## PAPER
*f. o. b. New York City*

| | per ton |
|---|---|
| Boards— | |
| Binders | 73.00 to 80.00 |
| Chip | 45.00- |
| Chip, sgl. mls. lined | 60.00- |
| Coated, white patent .016 | 80.00- |
| .020 and heavier | 75.00- |
| Kraft liner | 55.00- |
| News | 45.00- |

| | per cwt. |
|---|---|
| Book (eased) | |
| No. 1 Glossy Coat | 11.90 to 13.50 |
| No. 2 Glossy Coat | 10.25 to 11.75 |
| No. 3 Glossy Coat | 9.55 to 11.00 |
| No. 4 Glossy Coat | 9.15 to 10.50 |
| No. 2 Offset | 8.40 to 9.75 |
| A Grade M. F. | 7.20 to 9.50 |
| A Grade Super | 7.00 to 7.50 |
| B Grade M. F. | 6.70 to 8.75 |
| B Grade Super | 6.55 to 7.05 |
| B. S. & S. C. Litho | 6.95 to 7.30 |
| B. M. F. Litho | 6.95 to 9.00 |
| Ivory & India | .50 cwt. extra |
| Bonds (Rag Content)— | |
| 100% Rag | |
| Ext. No. 1 | 42.50 to 48.00 |
| 100% Rag | 40.25 to 46.00 |
| 85% Rag | |
| 75% Rag | 26.65 to 27.75 |
| 65% Rag | |
| 50% Rag | 20.15 to 22.00 |
| 25% Rag | 16.90 to 18.50 |
| Regular Colors | 1.00 cwt. extra |
| Bonds (Sulphite)— | |
| No. 1 | 9.25 to 11.50 |
| No. 2 | 8.50 to 10.25 |
| No. 3 | 8.05 to 9.25 |
| No. 4 | 7.70 to 9.50 |
| Colors | 1.00 cwt. extra |
| Glassine (f. o. b. mill)— | |
| Embossed (25 lb. up) | 14.00 to 14.25 |
| Bleached (25 lb. up) | 12.75 to 13.00 |
| Unbleach. (25 lb. up) | 11.25 to 11.50 |
| Greaseproof— | |
| Bleach. (25 lb. up) | 10.75 to 11.00 |
| Unbleach. (25 lb. up) | 9.75 to 10.00 |
| Ledgers (Rag Content)— | |
| 100% Rag | |
| Ext. No. 1 | 40.25 to 47.25 |
| 100% Rag | 32.20 to 37.75 |
| 85% Rag | 29.90 to 35.00 |
| 75% Rag | 24.75 to 29.00 |
| 65% Rag | 21.65 to 26.25 |
| 50% Rag | 18.70 to 22.75 |
| 25% Rag | 15.80 to 19.25 |
| Regular Colors | 1.00 cwt. extra |
| Ledgers (Sulphite)— | |
| No. 1 | 11.55 to 12.75 |
| No. 2 | 9.65 to 11.75 |
| No. 3 | 9.20 to 11.25 |
| No. 4 | 8.90 to 10.75 |

| | per ton |
|---|---|
| News— | |
| Rolls (Contract) | 49.00 to 50.00 |
| Rolls (Spot) | (nominal) |
| Sheets | 53.00 - |

| | per ream |
|---|---|
| Tissues (Carlots)— | |
| White, No. 1 | .97½ - |
| White, No. 2 | .75 to .77½ |
| Anti-Tarnish M. G. | .90 to 1.05 |
| Colored | .87½ to 1.10 |
| Kraft | .85 to .90 |
| Manila | .77½ to .80 |
| Napkins, semi-crepe (12½ lb. to M shts.) per cs | .41 - |
| Napkins, full crepe and emb'sed (12½ lb. to M shts.) per cs. | .43½ - |
| Toilet, Bleached (M shts.) per cs. | 5.80 - |
| Toilet, Unbleached (M shts.) per cs. | 3.50 - |

| | per case |
|---|---|
| Towels— | |
| Bleached | 3.10 to 3.65 |
| Unbleached | 1.95 to 3.30 |

| | per cwt. |
|---|---|
| Wrappings (Kraft)— | |
| Extra Quality | 5.25 to 6.00 |
| Super-Standard | 4.87½ to 5.25 |
| Northern Standard | 4.50 to 5.00 |
| Southern Standard | 4.50 to 5.00 |
| Wrappings (Sulphite and Bleached Kraft)— (Rolls, f. o. b. mill) | |
| Bleached papers— | |
| M.F.& M.G. Waxing, 20 lb. (Carloads only) | 6.40 to 6.65 |
| (10,000 lbs.) | 6.65 to 7.15 |
| Drug wrapp. 35 lb. | 6.50 to 6.75 |
| Unbleached Papers— | |
| Com. Grd. Butch. 40 lb. | 4.87½ to 5.12½ |
| No. 1 Butchers | 5.50 to 5.75 |
| No. 1 Imit. Parch & Dry Fin.Groc.Sulphite 30 lb. | 5.75 to 6.00 |
| No. 2 Imit. Parch & Dry Fin.Groc.Sulphite 30 lb. | 5.37½ to 5.62½ |
| Steam Finish, 50 lb. | 4.25 to 4.37½ |
| Water Finish, 40 lb. | 4.87½ to 5.12½ |
| Manilas— | |
| Envp. Mls., Sub. 16-40 (No. 1) | 5.50 to 5.75 |
| Envp. Mls., Sub. 16-28 (No. 2) | 5.25 to 5.50 |
| Envp. Mls. (Prices based on large sheets untrim'd reammarked, in bdls.) | |
| Wrapp. Mls. 35 lb. up— | |
| No. 1 | 5.50 to 5.75 |
| No. 2 | 5.25 to 5.50 |
| M. G. Sulphite and Kraft (other than Waxing) | |
| Grade A-25 lb. | 6.25 to 6.50 |
| Grade B-25 lb. | 6.00 to 6.12½ |